Stimulating creativity

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Stimulating Creativity

Matching Person and Context

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To Sem and Milan

“10 procent is half 6”
‘10 percent is half past 5’[1]

– Kiki, 4 years

[1] You may think: novel thought, but what does it mean (?!). Read on to find out what we can (not) do with such interesting (weird!) ideas.

Paranimfen
Laura Steenhuis
Irene Mostert
Friederike Doerwald

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1

Introduction:

Stimulating Creativity

CHAPTER 1

Introduction: Stimulating Creativity

In the current dissertation, I investigated what underlies our *perception* of ideas as being creative, and whether and by whom novel input is perceived as a creative contribution (Chapters 2 and 3). Additionally, I investigated whether various types of input are stimulating when brainstorming, and how this is affected by the individual characteristics of the perceiver (Chapters 3 and 4). How can the type of input be matched to the individual to reach optimal brainstorming outcomes (Chapters 3 and 4), and what cognitive pathways are used, and by whom, to generate ideas (Chapter 4)? But first things first: Creativity – why do we care?

Creativity – Why do we Care?

Creative ideas, those that are both novel and feasible, are wanted and needed by people and organizations (Hennessey & Amabile, 2010). Creativity is crucial for innovation and growth: it fosters new discoveries and positive change, enables people to respond effectively to unforeseen challenges, and is needed to flourish in an ever-changing environment (Zhou & Hoever, 2014). Being creative supports and increases well-being (Hirt, Devers, & McCrea, 2008) and is vital for the proactive development of new capabilities (Zhou & Hoever, 2014). Creativity is thus of great interest and meaning to individuals, teams, and organizations. Innovation, the successful implementation of creative ideas, creates the competitive advantage necessary to be able to stay ahead of competitors (Amabile, 1988). Hence, it is important to know more about how to create the optimal circumstances for people to generate creative ideas, and when this occurs, to ensure that theses ideas are also recognized as such.

Creativity – What is it About?

First, creative ideas are novel (Hennessey & Amabile, 2010). *Novelty* can be defined as the degree of newness and originality in the concepts, materials, or processes included in the idea. Whereas novelty is vital for creativity, novelty alone is not sufficient. To be considered creative, novel ideas should also be *feasible:* that is, have clear and practical applications, and fit with the problem or question at hand (Hennessey & Amabile, 2010). Highly original ideas that are not feasible or useful, or that cannot be implemented in practice, can be seen as weird or bizarre, and unrealistic. Note that generating feasible ideas that are not novel will not result in creativity either, but rather in common, everyday (or even boring!) ideas. The combination of novelty and feasibility is thus essential: Creative ideas are new and have clear and practical applications (Runco & Jaeger, 2012; Stein, 1953).

To illustrate how the elements of novelty and feasibility are both essential for creativity, consider the following example. A manufacturer thinks of possible new products for children, and after noticing that children like to imitate their fathers when shaving, comes up with a shaving razor for children. This could be seen as quite novel, something we do not encounter in everyday life, yet we can wonder to what extent an actual shaving razor for children would be useful (and safe!) in practice. As we will see in Chapter 3, such novel ideas could, however, still form a great starting point to build on when generating further ideas (at least for some). Here, the manufacturer could build on the razor idea to come up with a toy variant of a shaving razor, one that meets the criteria of being both new and feasible.

Creativity – How to get There? (Group) Brainstorming

A popular way to come up with creative ideas is brainstorming: generating a lot of ideas, and combining and improving these. The idea behind brainstorming is that the more ideas generated, the better: the greater the likelihood that they will include creative ideas. This is because novel ideas are frequently raw materials in their initial form and move toward

innovation through revision and improvement (Amabile, 1988; Csikszentmihalyi, 1997). People often work together in brainstorming groups, where members contribute with their different knowledge, expertise, and opinions. Osborn's (1957) brainstorming rules are often implemented to enhance creative idea generation in which (a) wild ideas are encouraged ("freewheeling") and (b) criticizing or judging ideas is left out. This way, ideas are not limited by rules or by standard ways of doing things. Also, (c) quantity is wanted, and (d) this is aimed at by combining and improving ideas.

Previous findings indicate that brainstorming groups have the potential, at least in theory, to perform better than the sum of their parts (i.e., all individuals separately), due to the exchange and collective processing of information (e.g., De Dreu, Nijstad, & van Knippenberg, 2008; Hinsz, Tindale, & Vollrath, 1997). Usually, however, brainstorming groups perform below their potential, and are less productive than individual brainstorming, as a result of production blocking (Diehl & Stroebe, 1987; Lamm & Trommsdorff, 1973; Nijstad & Stroebe, 2006). Being exposed to other group members' ideas can interfere with one's own idea generation process: for example, because one typically has to wait for another group member to stop talking before being able to contribute one's own idea. Furthermore, monitoring the shared input may lead to cognitive interference and distraction, resulting in less effective idea generation (Diehl & Stroebe, 1991; Nijstad, 2000).

Nevertheless, one important reason for working together on brainstorming tasks is the potential for *cognitive stimulation*: Being exposed to other people's ideas might enhance one's own idea generation process (e.g., Nijstad & Stroebe, 2006). When people are exposed to others' ideas, the features of these ideas can be used to increase productivity: generating new ideas through combining knowledge and forming new associations. Group brainstorming may increase idea diversity because group members can contribute different knowledge, expertise, and opinions to the group, which may trigger new ideas or areas of knowledge that

would not be as easily activated without some external cue (Brown, Tomeo, Larey, & Paulus, 1998; Dugosh, Paulus, Roland, & Yang, 2000; Nijstad & Stroebe, 2006).

Cognitive Stimulation

To understand how input and ideas from others can cognitively stimulate or interfere, it is helpful to understand the cognitive processes that are activated during brainstorming. The SIAM model (Search for Ideas in Associative Memory) describes brainstorming as a two-stage cognitive process, moving from activating knowledge to combining knowledge (Nijstad, Stroebe, & Lodewijkx, 2002; Nijstad & Stroebe, 2006). Knowledge activation involves retrieving previously stored knowledge on the topic, by forming a search cue in one's short-term memory that is used to explore one's long-term memory. The phase of combining knowledge starts when the search cue activates an image in one's memory. This image is used to generate new ideas by combining knowledge and forming new associations. This in turn activates more images and results in additional ideas that are semantically related (i.e., a 'train of thought'). The train of thought stops when it no longer results in new ideas, after which a new search cue has to be activated to generate additional ideas (Nijstad et al., 2002).

To illustrate the use of these cognitive processes, let's investigate the following example. When brainstorming on the topic of creating a healthy lifestyle, the cognitive process starts by investigating previous knowledge on the topic. This could activate the image of eating fruit as a way to achieve a healthier lifestyle. From this image, a train of thought is started, generating related ideas: eating fruit more often, taking vitamin pills, or wait (!), perhaps we can get more vitamins in a different way: we could add vitamins to chewing gum. This illustrates both what a train of thought can look like, and how generating more ideas on a subtopic can help to move away from everyday ideas that readily come to mind, towards more novel ideas (the more ideas, the better). After running out of ideas related to fruit, one

searches for a new image. Perhaps the idea of sport comes to mind, and the process of generating related ideas starts again.

On the one hand, receiving input when brainstorming can be very valuable and stimulating, especially when a person is running out of ideas or moving towards the end of a train of thought. In these instances, others' ideas can help to activate new search cues and move to new trains of thought (Nijstad et al., 2002). Also, input from others may help to activate categories that are less salient or obvious, providing a wider selection of categories to generate ideas from (Deuja, Kohn, Paulus, & Korde, 2014). On the other hand, external input can result in cognitive interference, activating images that misfit with one's own activated search cue (Diehl & Stroebe, 1991; Deuja et al., 2014; Nijstad, 2010; Nijstad et al., 2002). This input interrupts and thus shortens one's train of thought (Nijstad et al., 2002), resulting in the loss of potentially useful ideas and worse performance as compared with individual brainstorming (Diehl & Stroebe, 1987).

Previous research indicates that group brainstorming can result in conformity to the categories of ideas posed by others, resulting in less (rather than more) variety in the ideas generated (Kohn & Smith, 2011). This may be because input from others increases the cognitive retrieval strength of similar ideas, thereby weakening or blocking the activation of alternative ideas (Smith, 2003). At the same time, input can increase the number of ideas generated within that category, thus increasing the length of a train of thought. Input may thus lower the number of categories explored, but may enhance the in-depth exploration of these categories (Kohn & Smith, 2011). In the current dissertation, I posit that *one size does not fit all*, and investigate what types of input are effective for whom to improve brainstorming outcomes. This is explained below.

One Size Does not fit All: Matching Person and Context

The degree to which sharing ideas results in cognitive stimulation depends on factors such as the attention given to these ideas and the type of ideas shared, including their novelty and semantic diversity (Dugosh & Paulus, 2005; Nijstad et al., 2002). The novelty of ideas affects the ease with which they can be combined into new ideas: common input is more closely related to one's own semantic categories, and may therefore activate more associations than novel input would. At the same time, novel input may stimulate one to think of new categories or to include different perspectives from those one would otherwise have included (Leggert, 1997). The semantic diversity of input affects the diversity of ideas generated: input from a broad range of categories stimulates one to come up with more diverse ideas, whereas input from a smaller number of categories stimulates one to generate more in-depth ideas within these few categories (Nijstad et al., 2002).

Moving beyond previous research on types of input, I propose that the extent to which these types of input stimulate idea generation also depends on individual differences. The type of input that is perceived as valuable and creative by one person may be perceived as disruptive and impractical by another, thus either stimulating or diminishing creativity. This perspective is in line with the interactionist theory on creativity (Woodman, Sawyer & Griffin, 1993), which indicates that creativity evolves from a complex person-context interaction. Thus, "the characteristics of the job or task […] may have differential effects on the creativity of employees exhibiting different states or traits." (Zhou & Hoever, 2014, p.344). To understand creativity, we therefore need to have insight into the characteristics inherent to the person, the factors related to the context, and the interplay of both. In the person, both cognitive (such as preferred cognitive style) and non-cognitive aspects (such as personality) affect creativity (Woodman et al., 1993). This theory aligns with other researchers' views of creativity as well. For example, Amabile (1983) emphasized that

creativity results from the interplay between personal characteristics, cognitive abilities, and environments. Zhou and Hoever (2014) further specify the various forms the person-context interaction of the interactionist theory can take. When the effects of the person and context are both positive to creativity, this will have a synergistic result that mutually stimulates creativity. When the characteristics of the person tend to restrict creativity, but the context facilitates creativity (or the other way around), the positive element can compensate for the negative element, forming a remedy to overcome potential losses for creativity. Alternatively, the negative element may inhibit the otherwise positive element. Last, the interaction between negative effects of both the person and context will have an antagonistic result, increasing the detrimental effects and diminishing potential gains for creativity (Zhou & Hoever, 2014).

Overview of Chapters

In the current dissertation, I investigated both positive and negative person-situation factors and their interactions in creativity, and potential ways to overcome negative effects in order to stimulate the generation and recognition of creativity. Specifically, I examined whether people perceived novel ideas as creative, valued such ideas as end products or starting points for further idea generation (Chapters 2 and 3), and whether this held for both laypeople and creative experts (Chapter 2). I investigated what type of input (novel vs. non-novel in Chapter 3; homogeneous vs. diverse in Chapter 4) matched with the characteristics of the individual (individual needs for structure and autonomy in Chapter 3; approach-avoidance motivation in Chapter 4), to produce optimal brainstorming outcomes (cognitive stimulation, increased performance, task enjoyment). These types of individual differences relate to the core personality traits that are associated with creativity, which include aspects such as attraction to complexity, autonomy, and independence of judgment (Barron & Harrington, 1981), and relate to previous findings indicating that the way people attend to and make use of others' input depends on both epistemic and social motives (De Dreu et al., 2008). The

following section outlines the main findings per chapter in this dissertation.

1. *Does our common scholarly definition of creativity go hand-in-hand with people's perception of what constitutes a creative idea*? Not necessarily, as we[2] show in Chapter 2. In Chapter 2, we show that the extent to which ideas are perceived as being creative not only relates to characteristics of the ideas, such as their novelty and feasibility (Demirkan & Hasirci, 2009); it also seems to imply some sort of valuation or appreciation of the idea (Runco & Smith, 1992). We show that both wanted (i.e., perceived novelty and positive surprise) and unwanted elements (i.e., expected low feasibility and disruptiveness) are inherently associated with novel ideas. These elements differently affect the perception of creativity, and for both laypeople and people in creative industries, serially affect the expectations of success of novel ideas, willingness to endorse their implementation, and their perceived added value as a starting point for idea generation.

2. Is novel input stimulating in generating creative ideas? Not for everyone, as we show in Chapter 3. In Chapter 3, we show that perceiving the creativity in novel ideas forms a necessary first step to be cognitively stimulated by the input (that is, arrive at more productivity, idea diversity, task enjoyment, and not feeling blocked). Here, we aimed to address the inconsistent finding in the brainstorming literature that cognitive stimulation sometimes results from novel input (e.g., Berg, 2014), yet other times from non-novel input (e.g., Dugosh & Paulus, 2005). We demonstrate that the link between input novelty and cognitive stimulation partly depends on people's psychological needs for structure and autonomy. Additionally, we show that the perceived creativity of the input mediates this relationship, in line with previous research indicating that the role of novelty in the perception of creativity is less than straightforward (e.g., Mueller, Wakslak, & Krishnan, 2014; De

[2] In the remainder of the dissertation, I will use the term "we" rather than "I" to reflect the contributions of my co-authors.

Jonge, Rietzschel, Van Yperen & Mueller, 2019 (Chapter 2)).

3. How do we use input to come up with creative ideas? In Chapter 4, we show that input diversity and individual differences determine the effectiveness of two cognitive pathways to generate ideas when brainstorming. Previous research indicates that input can result in cognitive stimulation both when it covers a wide and when it covers a small range of perspectives (i.e., is high or low in diversity) (Nijstad, Stroebe, & Lodewijkx, 2002). The extent to which input does so may depend on individual differences (also see, De Jonge, Rietzschel, Van Yperen, 2018 (Chapter 3)) that are associated with a preference for a particular cognitive pathway towards creativity. Approach-motivated people tend to use a flexible cognitive pathway that is characterized by generating ideas from diverse semantic categories, whereas avoidance-motivated people use a persistent cognitive pathway by generating ideas from deeper within few semantic categories. We argue and demonstrate that both the type of input and people's approach-avoidance motivation determine which cognitive pathway results in creative idea generation.

By focusing on these person-situation interactions throughout the dissertation, I aimed to create more insight into when and how ideas are perceived as creative, as well as to understand the conditions that stimulate rather than inhibit creative performance. This way, we can better understand the mechanisms through which creative performance unfolds. And, when creative ideas are generated, we can increase the likelihood that these ideas will also be recognized as such. This will increase the likelihood that individuals, teams, and organizations can benefit from the creative ideas generated.

2

What Constitutes a Creative Idea?

Why, and for Whom, and For Doing What?

Creative ideas are wanted and needed by people and organizations, to come to new discoveries and innovation. However, little is known about what constitutes a creative idea, and why, and for whom, and for doing what. The aim of the present research was to demonstrate that the perception of creativity is affected not only by characteristics of the idea itself, but also by what people think that novel ideas can result in: Creativity is for doing. With three experimental studies, we show that both wanted (i.e., perceived novelty and positive surprise) and unwanted elements (i.e., expected low feasibility and disruptiveness) are inherently associated with novel ideas. These elements differently affect perceptions of creativity, and for both laypeople and people in creative industries, serially affect the expectations of success of novel ideas, willingness to endorse their implementation, and their perceived added value as a starting point for idea generation. [3]

[3] This Chapter is based on De Jonge, K. M. M., Rietzschel, E. F., Van Yperen, N. W., & Mueller, J. S. (2019). *What Constitutes a Creative Idea? Why, and for Whom, and For Doing What?* Manuscript submitted for publication.

CHAPTER 2

What Constitutes a Creative Idea?

Why, and for Whom, and For Doing What?

Creative ideas are wanted and needed by people and organizations, for new discoveries, innovation, and positive change, and to flourish in an ever-changing environment (Hennessey & Amabile, 2010). For ideas to form a creative contribution, the combination of novelty and feasibility is important: shedding a new light on the task at hand and being adaptive to reality (Hennessey & Amabile, 2010; Stein, 1953). People are generally able to recognize creativity and to distinguish uncreative from creative ideas (e.g., Allen, 2010; De Jonge, Rietzschel, & Van Yperen, 2018; Lu & Luh, 2012; Rietzschel & Ritter, 2018). However, little is known about what underlies our *perception* of ideas as being creative (Klein & Knight, 2005; Mumford, 1999). The scholarly definition and the lay definition of what constitutes a creative contribution are not necessarily aligned (e.g., Loewenstein & Mueller, 2016). The extent to which ideas are perceived as being creative not only relates to characteristics of the ideas, such as their novelty and feasibility (Demirkan & Hasirci, 2009); it also seems to imply some sort of valuation or appreciation of the idea (Runco & Smith, 1992). The aim of the present research was to argue and demonstrate that the perception of creativity is also affected by what people think that novel ideas can result in. Echoing Fiske (1992), we propose that 'creativity is for doing': creative ideas are generated for a purpose, and perceptions of creativity are, we argue, at least partly determined by the expected consequences of the ideas. In Study 1, we show that wanted and unwanted elements are inherently associated with new ideas and new possibilities, and differently affect the perception of creativity. In Studies 2 and 3, we show that for both laypeople and experts in creative industries, the perception of novel ideas relates to whether *doing* is defined as the immediate implementation of the idea or as a starting point for further idea generation.

Opening (Un)desired New Doors

Novelty is the key characteristic distinguishing creative from common ideas (e.g., Campbell, 1960; Guilford, 1957), but is not the only relevant element in the perception of creativity. We expected that novel ideas (relative to non-novel ideas) would be perceived as creative, and as creative contributions, when these advanced doing by adding value for a specific task or situation and by advancing the field or topic at hand (cf. Csikszentmihalyi, 1990; Fiske, 1992). Ideas perceived as creative provide a new perspective or shed a different light on the problem at hand, are seen as having great potential, and stimulate all kinds of associations and further idea generation. These ideas are perceived as a *desired* and useful contribution. Indeed, previous research indicates that those who perceive novel ideas as a creative contribution, not only perform better, but also enjoy the brainstorm task more (De Jonge et al., 2018). Novel ideas that are perceived as creative seem to open desired new doors that people appreciate, eliciting a feeling of newness and positive surprise. At the same time, novel ideas can also open *undesired* new doors that people dislike, when they elicit feelings of low feasibility and high disruptiveness, and are perceived as being of little use for the task or for practice. We therefore suspect that wanted (i.e., perceived novelty and positive surprise) and unwanted elements (i.e., expected low feasibility and disruptiveness) differently affect the perception of creativity of novel ideas. We discuss these elements next.

Perceived novelty can be defined as the degree of newness and originality in the concepts, materials, or processes included in the idea. When generating ideas, novelty is explicitly sought and sharing wild ideas is encouraged (Osborn, 1957) . Novelty can be reached by combining ideas in a different way or taking a different perspective, and stimulates creativity and new idea generation. People are generally able to recognize creativity on the basis of novelty, although some people seem to do so better than others (Allen, 2010; Lu & Luh,

2012; De Jonge et al., 2018; Rietzschel & Ritter, 2018). Whereas novelty is vital for creativity (e.g., Campbell, 1960; Guilford, 1957), novelty alone is not sufficient.

When novel ideas open desired new doors, these ideas are likely to elicit not only a feeling of newness, but also *positive surprise*. This happens when the newness, originality, and unexpectedness create new possibilities and perspectives that we appreciate and perceive to be of added value. Some research indeed suggests that surprise is an important element of creativity (Besemer, 1998; Bruner, 1962; Simonton, 2018). Creative ideas often provide new possibilities that were not anticipated at the start, providing new information or putting things in new perspectives. The level of surprise increases with the amount of new knowledge, skills, or expertise gained after evaluating the idea, which is likely to increase with more creative ideas (Simonton, 2018). Previous research also indicates that novel artistic products enhance a feeling of surprise (Besemer, 1998), and positive surprise may thus be an important additional element in the perception of creativity.

Novel ideas open undesired new doors when they are perceived as low in feasibility. To be considered creative, novel ideas should also be feasible: that is, have clear and practical applications, and fit with the problem or question at hand (Runco & Jaeger, 2012; Stein, 1953). Paradoxically, however, the element of novelty also evokes negative associations that may lower the perception of creativity due to unfamiliarity and *expected low feasibility* and usefulness. As a result, people and organizations sometimes prefer ideas lower in novelty (e.g., Mueller, Melwani, & Goncalo, 2012; Osborn, 1957; Rietzschel, Nijstad, & Stroebe, 2010; Staw, 1995). Also, people often view novelty and feasibility as elements that are oppositely related (which indeed they often are; see Nijstad, De Dreu, Rietzschel, & Baas, 2010; Rietzschel et al., 2010), and rate the artistic products that are seen as the most novel and surprising as the least useful and valuable (Besemer, 1998).

Additionally, the judgment of ideas is often biased against novelty, indicating that novel ideas are held to higher standards of usefulness than less novel ideas, resulting in under-selection of these ideas (Mueller et al., 2012; Osborn, 1957; Rietzschel et al., 2010). As suggested by Litchfield, Gilson, and Gilson (2015), novel ideas may face additional criteria for selection and appreciation (e.g., needing to be feasible and adding value), compared with more lenient criteria for non-novel ideas (e.g., needing to be feasible). Novel ideas may thus be perceived as not feasible or useful, or as not implementable in practice (even when normative feasibility is held constant over novel and less novel ideas). The main threat to perceiving the creativity of novel ideas may be the perceived tension between novelty and feasibility (cf. Rietzschel, Nijstard, & Stroebe, 2018). That is, novel ideas very well could be feasible, but the more novelty, the more uncertainty exists about whether the idea is feasible.

Another unwanted element of novel ideas is that these can be perceived as *disruptive*. Novel ideas may disrupt, as their newness, originality, and unexpectedness can also create additional aspects and unpredictability that have to be dealt with. Disruptive ideas are ideas that are perceived as novel and as feasible, but as creating little added value (Litchfield et al., 2015). As novel ideas are less closely related to one's own mental images and existing knowledge, this makes it harder to assess how the ideas fit in with the task at hand or align with one's own perspective (Dugosh & Paulus, 2005). This may explain why people sometimes fail to recognize the creativity and added value of novel ideas (Schulz, 2001).

To sum up, we expected that novel ideas would be perceived as more novel, more surprising, less feasible, and more disruptive than non-novel ideas. We further expected that perceived novelty and surprise would *positively* contribute to the perceived creativity of ideas, whereas expected low feasibility and perceived disruptiveness would *negatively* contribute to perceived creativity (see Figure 1a, p. 22). As the element of novelty is the most important factor when recognizing creativity (Diedrich, Benedek, Jauk, & Neubauer, 2015), we

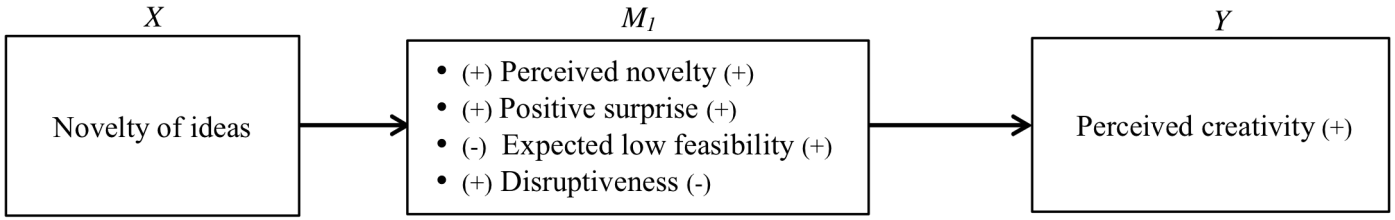

Figure 1a. The first part of our theoretical model. The effect of idea novelty (X) on perceived creativity of ideas (Y), mediated by four elements of the idea, namely: perceived novelty, positive surprise, expected low feasibility, and disruptiveness (M).

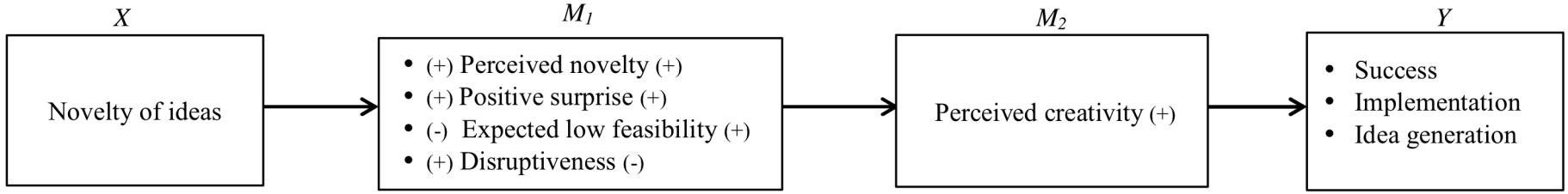

Figure 1b. Our full theoretical model. The effect of idea novelty (X) on the expected success of ideas, the willingness to endorse implementation, and the added value as a starting point for idea generation (Y). This relation is serially mediated by four elements of the idea, namely perceived novelty, positive surprise, expected low feasibility, and disruptiveness (M1), and subsequently, by the perceived creativity of the ideas (M2).

expected that people would generally be able to perceive more creativity in novel ideas as compared with non-novel ideas. We investigated these expectations in Study 1. In two additional experiments, we examined our full theoretical model (see Figure 1b, p. 24) among both laypeople (Study 2) and people in creative industries (Study 3).

Method Study 1

Sample and Design

Participants took part in an online MTurk study to assess brainstorm ideas on the topic of creating a healthy lifestyle. They participated voluntarily for an incentive ($1). Of the total of 202 participants, 41 participants were dropped from all analyses as their data were unreliable.[1] Participants were randomly assigned to assess ideas that were either high or low in normative novelty (Zhou, May Wang, Jiwen Song, & Wu, 2016). These ideas were, exploratively, framed in two different ways: either as input received from a colleague, or as general ideas that people could come up with while brainstorming. This resulted in a 2x2 factorial design:[2] non-novel input (n = 42), non-novel ideas (n = 40), novel input (n = 41), and novel ideas (n = 38). Participants' ages ranged between 20 and 69 years (M = 36.18, SD = 10.69). Most of the participants were native English speakers (98%). Most held no paid job (27%), or worked in public administration (10%), retail trade and catering (9%), healthcare and social assistance (8%), or education (8%).

Procedure

The participants filled in the survey online, which took around 12 minutes to complete. They were told that the focus of this study was to examine perceptions of ideas, and were presented with a scenario: They were instructed to imagine brainstorming on the topic of achieving a healthier lifestyle and were presented with the four brainstorming rules (see

Osborn, 1957). We asked the participants to read the stimulus ideas for two minutes and to imagine if and how they would use these to come up with new ideas themselves. The participants were then asked to assess these ideas as a whole (using a 'snapshot' procedure; see, for example, Silvia, Martin, & Nusbaum, 2009). Some additional explorative questions were included concerning individual needs (scale from Van Yperen, Rietzschel, & De Jonge, 2014). Last, the participants answered questions regarding their demographics, and were thanked and debriefed.

Manipulation of Stimulus Ideas. The participants were presented with a total of nine stimulus ideas that had previously been rated by two independent experts in earlier unrelated research (Rietzschel, De Dreu, & Nijstad, 2007) as either non-novel or novel, and as moderate on feasibility.[3] An example of a non-novel stimulus idea to increase health read "Don't smoke", and a novel idea read, "Add vitamins to chewing gum."

These ideas were, exploratively, framed in two different ways: Half of the participants were instructed to imagine that the stimulus ideas they would receive were input from a colleague, the other half were instructed to imagine that these were possible ideas that people in general could come up with.[2] The results of our 2x2 factorial design indicated no difference in outcomes when the questions were framed as general ideas or specific input: no main effect (b = -.09, 95% CI: [-.33; .14]) and no interaction effect with (non-)novel stimuli (F (1, 153) = 1.12, p = .29]). For the sake of clarity and comprehensibility, we therefore do not further discuss the framing conditions.

Materials

Participants responded on a 5-point Likert scale ranging from 1 ('not at all') to 5 ('very'). See Table 1 for all items per variable. Cronbach's alphas of all variables are displayed in Table 2.

Table 1. *Items Per Variable – Studies 1 to 3*

Variable	Questions
Mediators	
Perceived novelty	I would consider these ideas…
	novel
	original
	unique
Expected low feasibility	I would consider these ideas….
	feasible
	applicable
	practical
Positive surprise	These ideas made me feel …
	amazed
	astonished
	astounded
	positively surprised
Disruptiveness	I would consider these ideas…
	annoying
	unhelpful
	useless
Dependent variable	
Perceived creativity	I would consider these ideas…
	creative
	innovative
	novel and useful
	(Mueller, Wakslak, & Krishnan, 2014)

Table 2. *Descriptives, Correlations, and Cronbach's Alphas – Study 1*

Variable	Mean	SD	1	2	3	4	5	6	7	8
1. Gender	NA	NA	NA							
2. Age	36.18	10.69	.14†	NA						
3. Condition	NA	NA	.02	.11	NA					
4. Perceived Novelty	2.79	1.14	-.12	-.09	.26**	(.90)				
5. Pos. Surprise	1.76	.94	-.01	.07	.17*	.54**	(.93)			
6. Expected Low Feasibility	2.92	1.16	.12	.05	-.29**	-.49**	-.15†	(.93)		
7. Disruptiveness	1.97	1.08	-.09	.03	.16*	.38**	.03	-.66**	(.87)	
8. Perceived Creativity	2.76	1.00	-.01	-.01	.18*	.77**	.58**	-.12	.02	(.77)

Note. $n = 161$. † $p < .10$; * $p < .05$; ** $p < .01$. When applicable, the corresponding Cronbach's alpha is displayed on the diagonal.

Gender coded as 1 for male and 2 for female. Condition coded as 1. Non-novel input, 2. Novel input, 3. Non-novel idea, 4. Novel idea.

Results Study 1

Descriptives, correlations, and Cronbach's alphas of all variables are given in Table 2. The highest correlations were obtained for perceived creativity with perceived novelty (.77, $p < .001$) and positive surprise (.58, $p < .001$), as well as between disruptiveness and feasibility (-.66, $p < .001$). The latter indicates that ideas perceived as disruptive were also perceived as infeasible. Participants on the whole perceived novel ideas as more creative than non-novel ideas, $F(3, 157) = 17.73$, $p < .001$ ($M_{non\text{-}novel\ input} = 2.43$, $M_{non\text{-}novel\ idea} = 2.12$, $M_{novel\ input} = 3.19$, $M_{novel\ idea} = 3.33$). Sex and age were evenly distributed across conditions, $\chi^2_{sex}(1, N = 161) = 1.86$, $p = .21$; $F_{age}(3, 157) = .69$, $p = .56$ ($M_{non\text{-}novel\ input} = 37.26$, $M_{non\text{-}novel\ idea} = 37.53$, $M_{novel\ input} = 35.44$, $M_{novel\ idea} = 37.26$).

Model Test

In Study 1, we tested the first part of our theoretical model as visualized in Figure 1a, p. 24. That is, a parallel mediation model was estimated to test whether idea novelty influences perceived creativity through the elements of perceived novelty, positive surprise, expected low feasibility, and disruptiveness. We used Hayes' (2013) PROCESS SPSS macro (model 5) to estimate the four indirect effects in parallel to control for the unique variance explained by each mediator. A bias-corrected bootstrapping sample size of 5000 was used to obtain the 95% confidence intervals (CI). The results indicated that all four elements mediated the relation between idea novelty and perceived creativity. Idea novelty produced a positive effect on perceived creativity through the elements of perceived novelty and positive surprise, and a negative effect through the elements of expected low feasibility (with a negative coefficient on the path from idea novelty to feasibility) and disruptiveness (with a negative coefficient on the path from disruptiveness to perceived creativity).[2] The specific paths of each mediator are described below.

Perceived novelty. Indirect effects and bootstrapped CIs for novelty indicated a positive effect of idea novelty on perceived novelty (*b* = 1.58, 95% CI: [1.32; 1.84]), and a positive effect of perceived novelty on perceived creativity (*b* = .69, 95% CI: [.58; .80]. A positive indirect effect of idea novelty on perceived creativity through perceived novelty was obtained as well (*b* = 1.09, 95% CI: [.85; 1.35])

Expected low feasibility. A negative effect of idea novelty on feasibility was obtained (*b* = -1.53, 95% CI: [-1.80; -1.26]), and a positive effect of feasibility on perceived creativity (*b* = .22, 95% CI: [.11; .34]). Combining these two, the indirect effect of idea novelty on perceived creativity through feasibility was negative (*b* = -.34, 95% CI: [-.49; -.20]).

Positive surprise. A positive effect of idea novelty on surprise was obtained (*b* = .80, 95% CI: [.53; 1.07]), and a positive effect of surprise on perceived creativity (*b* = .16, 95% CI: [.05; .28]). A positive indirect effect of idea novelty on perceived creativity through positive surprise was obtained as well (*b* = .13, 95% CI: [.04; .26]).

Disruptiveness. A positive effect of idea novelty on disruptiveness was obtained (*b* = .96, 95% CI: [.66; 1.27]), as was a negative effect of disruptiveness on perceived creativity (*b* = -.14, 95% CI: [-.25; -.04]. Combining these two, the indirect effect of idea novelty on perceived creativity through disruptiveness was negative (*b* = -.14; 95% CI: [-.27; -.04]).

Further analyses. Consistent with previous findings in the literature, pairwise comparisons indicated that the element of perceived novelty had the strongest link with perceived creativity (vs. feasibility = 1.43, CI: [1.14; .1.73], vs. positive surprise = .96, CI: [.69; 1.25], vs. disruptiveness = 1.23, CI: [.96; 1.53]). Additionally, positive surprise had a stronger link with perceived creativity than did feasibility (.47, CI: [.31; .65]) and disruptiveness (.27, CI: [.14; .44]). There was no evidence of a direct effect of normative novelty on perceived creativity when this was framed as novel input (*b* = .14, 95% CI: [-.19; .47]), but a positive direct effect was present when it was framed as novel ideas (*b* = .32, 95%

CI: [.01; .64]). In both instances, it seems that the four elements depicted (perceived novelty, positive surprise, expected low feasibility, and disruptiveness, in decreasing order of magnitude) all make an important contribution to the perceived creativity of novel ideas, either positively or negatively affecting this perception.

Discussion Study 1 and Introduction Studies 2 and 3

As expected, the results of Study 1 indicate that all proposed mediators, i.e., perceived novelty, positive surprise, expected low feasibility, and disruptiveness, affected the perceived creativity of novel ideas (as compared with non-novel ideas). Whereas perceived novelty and positive surprise add to the perception of novel ideas as creative, the expected low feasibility and disruptiveness of novel ideas lower the perception of creativity. That is, novel ideas are perceived as more novel and as positively surprising, and this in turn increases their perceived creativity. At the same time, novel ideas are perceived as less feasible and more disruptive, and this in turn lowers the perception of creativity. This supports our notion that novel ideas open up new possibilities that have wanted and unwanted elements, which in turn differently affect the perception of creativity.

Creativity is For Doing – *But Doing What?*

Echoing Fiske (1992), we propose that 'creativity is for doing': creative ideas are generated for a purpose, and perceptions of their creativity are, we argue, at least partly determined by their expected consequences. Valuing creativity by the extent to which it advances doing may depend on what *doing* means. That is, one may evaluate an idea with an eye to (immediate) implementation (i.e., as being an end product), or one may evaluate an idea as a starting point for further elaboration and refinement. This description of *doing* results in the serial mediation model depicted in Figure 1b (p. 24), moving from perceived creativity to endorsement-related outcomes: this is discussed next.

Doing as implementation. Due to possible negative associations with novel ideas (Zhou et al., 2016), people may be less willing to support and implement a novel idea that is perceived as creative when *doing* is defined as (immediate) implementation of the idea (i.e., the idea as being an end product, and as being at the end of the idea journey) (Perry-Smith & Mannuci, 2016). The question "Why do something different just because we can?" may arise, illustrating why people sometimes find it hard to see the possibility, or added value, of immediate implementation of novel ideas (Litchfield et al., 2015). Indeed, research on creative end products indicates that although people can recognize creative ideas, they tend not to select these ideas (Rietzschel et al., 2010). The aspect of novelty can elicit resistance when deciding whether to endorse and immediately implement such ideas, and can even result in an implicit bias against creativity (Mueller et al., 2012). People often dismiss creative end products, even when creativity is an important goal to them (Staw, 1995). We therefore expect that people are less positive towards novel ideas when doing is defined as the immediate *implementation* and *success* of these ideas, rather than when doing is defined as using these ideas as a starting point for idea development.

Doing as further development. Indeed, when *doing* is defined as a starting point for further elaboration and *idea generation*, the perceived added value of novel ideas may be more positive. Rather than focusing on their (possible lower) readiness for implementation and feasibility for practice, people can also perceive novel ideas as being at the start of the idea journey: as interesting raw materials that provide great potential for innovation by revising and improving them (Amabile, 1988; Csikszentmihalyi, 1997; Litchfield et al., 2015; Perry-Smith & Mannucci, 2016). Previous research as least indicates that recognizing the creative potential in novel ideas forms a prerequisite for using these ideas for further idea generation (De Jonge et al., 2018), and for investigating and further developing these promising initial ideas into useful and innovative products or materials (West, 2002; Zhou et

al., 2016). For example, teams select more creative ideas when they actively reflect on the ideas and build on these reflections for further idea generation (Rietzschel et al., 2018; Toh & Miller, 2016).

Together with the posited elements that mediate perceived creativity, this results in a serial mediation as depicted in Figure 1b, p. 24. We expected that people are less positive towards novel ideas that are perceived as creative when thinking of the immediate implementation of these ideas or of the chances that these ideas are ultimately successful, and are more positive towards using these ideas as a starting point for idea generation.

For Whom **does it Hold?**

The extant literature suggests that novelty is a crucial determinant of how creative an idea is perceived to be, but this might to some extent depend on characteristics of the raters themselves (De Jonge et al., 2018). Findings on the effects of (non)-expertise in evaluating and rating creativity are mixed. Some indicate that the complexity of evaluating creativity is affected both by characteristics of the idea (such as its novelty) and by characteristics of the evaluators, such as their expertise and experience with creativity (Dijkstra, van der Pligt, & van Kleef, 2013; Galati, 2015). These findings indicate that laypeople and experts do not evaluate creativity similarly, and that only ratings by experts and quasi-experts are reliable (Kaufman, Baer, Cropley, Reiter-Palmon, & Sinnett, 2013; Kaufman, Gentile, & Baer, 2005), and that a minimum of domain knowledge of the topic at hand is required to evaluate creativity (Galati, 2015; Kaufman et al., 2013). In line with this, the consensual assessment technique (CAT) to assess creativity indicates that creativity evaluations are most valid when provided by experts in the domain (Amabile, 1982, 1996).

Other research shows no effect of expertise on evaluating creativity. These studies indicate that both laypeople and experts form meaningful judgments of artistic products (Besemer, 1998) and creative ideas (Rietzschel et al., 2010), the latter indicating that both

laypeople and trained raters view similar ideas as original and feasible. Other research indicates similar findings, especially when the topic is familiar to laypeople, creating little complexity for them in evaluating creativity (Galati, 2015). Also, Hekkert and Wieringen (1996) reported strong agreement between laypeople and experts when evaluating the originality, but not the quality, of artistic work.

In the current paper, rather than comparing the creativity ratings given by laypeople and experts, we investigated whether *perceptions* of creativity are constituted similarly within these two groups. As few researchers have investigated this topic, we investigated it in an explorative way, but there is some indication that perceptions of creativity may be formed similarly for laypeople and experts. Research by Baas, Koch, Nijstad, and De Dreu (2015) at least indicates that (in contrast to their expectation), beliefs about creativity are not strongly affected by expertise or people's relevant experiences. These beliefs about the processes, mind states, and activities that enhance creativity influenced the creativity-related choices people made. These beliefs appeared to be consistent across populations, and were not affected by creative expertise. To further examine perceptions of creativity across laypeople and creative experts, in Studies 2 and 3, we tested our theoretical model among laypeople and people from creative industries, respectively.

Method Study 2

Sample and Design

We conducted a second experiment to test whether we could replicate the findings from Study 1, and to further extend our theoretical model by investigating whether or not participants perceived novel ideas as successful, would endorse the implementation of these ideas, and perceived them as a useful starting point to generate further ideas. Participants took part in an online MTurk study to assess brainstorm ideas on the topic of creating a healthy lifestyle. They participated voluntarily for an incentive ($1). Of the total of 257 participants,

30 participants were dropped from all analyses, as their data were unreliable. We used the same exclusion criteria as in Study 1.[1] Participants were randomly assigned to assess ideas that were either high or low in normative novelty, and which were framed as input from a colleague. This resulted in two conditions: non-novel ideas (n =113) and novel ideas (n = 114). Participants' ages ranged between 18 and 73 years (M = 36.89, SD = 11.39). Most of the participants were native English speakers (99.6%). Most had no paid job (33%), others worked in information technology (13%), healthcare and social assistance (8%), retail trade and catering (7%), and education (6%). The same procedure as in Study 2 was used.

Materials

The same materials as in Study 1 were included, with the following additional scales for the three outcome variables. Participants responded on a 5-point Likert scale ranging from 1 ('not at all') to 5 ('very'). See Table 3 for all items per variable. Cronbach's alphas of all variables are displayed in Table 4.

Table 3. *Items Per Variable – Study 2 and 3*

Variable	Questions
Success	I think implementing these ideas will be a success.
	Implementing these ideas will result in innovation.
	I am uncertain about the success of these ideas. (R)
Implementation	When working on this project, I would…
	… aim to implement these ideas.
	… think these ideas should be realized.
	… investigate and secure funds needed to implement these ideas.
	… develop adequate plans and schedules for the implementation of these ideas.
Idea generation	These ideas form a great starting point to build on.
	I would want to use these ideas to generate further ideas.
	These ideas stimulate me to come to more ideas.
	Reading these ideas, all kind of additional ideas come to mind.

Table 4. *Descriptives, Correlations, and Cronbach's Alphas – Study 2*

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1. Gender	NA	NA	NA										
2. Age	37.89	11.39	.05	NA									
3. Condition	NA	NA	.02	.09	NA								
4. Perceived Novelty	2.88	1.20	.08	-.01	.73**	(.91)							
5. Pos. Surprise	1.90	1.00	.04	-.07	.41**	.58**	(.93)						
6. Exp. Low Feasibility	2.99	1.13	.05	-.14	-.66**	-.47**	-.17**	(.92)					
7. Disruptiveness	1.83	1.02	-.05	-.03	.39**	.26**	.20**	-.49**	(.89)				
8. Perceived Creativity	2.83	1.02	.12†	-.05	.59**	.86**	.57**	-.24**	.08	(.79)			
9. Success	2.77	1.04	.05	-.27**	-.49**	-.19**	.03	.66**	-.54**	.03	(.75)		
10. Implementation	2.53	1.13	-.04	-.30**	-.49**	-.26**	.03	.72**	-.48**	-.06	.82**	(.96)	
11. Idea Generation	3.13	1.10	.09	-.09	-.33**	-.07	.13	.50**	-.52**	,09	.65**	.58**	(.91)

Note. $n = 227$. † $p < .10$; * $p < .05$; ** $p < .01$. When applicable, the corresponding Cronbach's alpha is displayed on the diagonal. Gender coded as 1 for male and 2 for female. Condition coded as 1 for non-novel and 2 for novel ideas.

Results Study 2

Descriptives, correlations, and Cronbach's alphas of all variables are given in Table 4. The highest correlations were obtained between the newly included variables: endorsing implementation and expected success (.82, $p < .001$). High correlations were also obtained for perceived novelty with condition (.73, $p < .001$) and with perceived creativity (.86, $p < .001$). The latter correlations are consistent with previous research indicating that perceived novelty is the strongest predictor for perceived creativity. Also, as expected, participants on the whole perceived novel ideas as more creative than non-novel ideas ($M_{\text{non-novel}} = 2.62$ vs $M_{\text{novel}} = 3.43$, $F(1, 226) = 118.53$, $p < .001$). Regarding the outcome variables, participants were somewhat more positive about the presented ideas as a starting point for further idea generation ($M = 3.13$) than in terms of direct implementation ($M = 2.53$) or success ($M = 2.77$). Sex and age were evenly distributed across conditions ($\chi^2_{\text{sex}}(1, N = 227) = .11$, $p = .74$; $F_{age}(1, 225) = 1.77$, $p = .18$ ($M_{\textit{non-novel ideas}} = 36.88$ vs $M_{\textit{novel ideas}} = 38.89$).

Hypothesis Testing

We used Hayes' (2013) PROCESS SPSS macro (model 6), with a bootstrapping sample size of 5000, to test the sequential mediation model that idea novelty would predict the expected success of ideas, the willingness to endorse their implementation, and their perceived value as a starting point for idea generation. This went through the posited elements that mediate the perceived creativity of novel ideas, resulting in the sequential mediation depicted in Figure 1b, p. 24. Following Hayes (2013), rather than conducting separate mediation analyses for parts of our model, we tested the total sequential model in one analysis for each of the dependent variables.[5] The advantage of this approach is that it enabled us to test each mediator's indirect effect ($X \rightarrow M_1 \rightarrow Y$) and ($X \rightarrow M_2 \rightarrow Y$), as well as the sequential indirect effect by moving through both of the mediators ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$) (Van Jaarsveld et al, 2010).

Table 5. *Bootstrap S for each of the Mediators and Outcome Variables – Study 2*

	Expected success		Implementation		Idea generation	
Perceived Novelty	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect, X → Y	**-1.26**	**[−1.58, −.93]**	**-1.35**	**[−1.71, −1.00]**	**-1.24**	**[−1.61, -.86]**
$M_2 \rightarrow Y$	**.65**	**[.44; .86]**	**.61**	**[.38; .84]**	**.50**	**[.26; .74]**
Total indirect effect	**.33**	**[.07; .60]**	.24	[-.03; .52]	**.51**	**[.23; .81]**
$X \rightarrow M_1 \rightarrow Y$	**-.45**	**[−.81, −.07]**	**-.49**	**[−.87, −.09]**	-.07	[−.20, .03]
$X \rightarrow M_2 \rightarrow Y$	-.09	[−.25, .04]	-.09	[−.22, .04]	-.07	[−.20, .03]
$X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$	**.88**	**[.56, 1.21]**	**.82**	**[.53, 1.25]**	**.67**	**[.32, 1.03]**
Positive Surprise						
Direct effect, X → Y	**-1.49**	**[−1.77, −1.22]**	**-1.63**	**[−1.93, −1.33]**	**-1.33**	**[−1.64, −1.02]**
$M_2 \rightarrow Y$	**.40**	**[.25; 55]**	**.29**	**[.13; .46]**	**.36**	**[.19; .53]**
Total indirect effect	**.56**	**[.37; .68]**	**.52**	**[.33; .73]**	**.60**	**[.40; .83]**
$X \rightarrow M_1 \rightarrow Y$	.08	[−.05, .23]	**.16**	**[.03, .31]**	**.16**	**[.03, .33]**
$X \rightarrow M_2 \rightarrow Y$	**.35**	**[.19, .54]**	**.26**	**[.10, .44]**	**.31**	**[.06, .19]**
$X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$	**.13**	**[.07, .21]**	**.09**	**[.04, .17]**	**.12**	**[.06, .19]**

Note. If CI does not include zero, the effect is considered statistically significant and is displayed in bold. $n = 227$

Table 5 (Continued). *Bootstrap S for each of the Mediators and Outcome Variables – Study 2*

	Expected success		Implementation		Idea generation	
Expected Low Feasibility	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect, X → Y	**-.53**	**[−.85, −.21]**	**-.41**	**[−.74, −.07]**	**-.57**	**[−.97, −.18]**
M_2 → Y	**.32**	**[.20; .44]**	**.32**	**[.20; .44]**	**.36**	**[.21; .51]**
Total indirect effect	**-.40**	**[-.69; -.10]**	**-.71**	**[-1.03; -.37]**	-.15	[-.53; .22]
X → M_1 → Y	**-.40**	**[−.69, −.10]**	**-.98**	**[−1.22, −.175]**	**-.59**	**[−.85, −.34]**
X → M_2 → Y	**-.09**	**[.50, .71]**	**.36**	**[.17, .56]**	**.56**	**[.33, .84]**
X → M_1 → M_2 → Y	**-.11**	**[-.21, -.04]**	**-.08**	**[-.16, -.03]**	**-.13**	**[-.23, -.05]**
Disruptiveness						
Direct effect, X → Y	**-1.08**	**[−1.36, −.80]**	**-1.24**	**[−1.58, −.92]**	**-.82**	**[−1.13, −.50]**
M_2 → Y	**.37**	**[.24; .50]**	**.32**	**[.18; .47]**	**.37**	**[.22; .51]**
Total indirect effect	.15	[-.09; .38]	.13	[-.13; .37]	.09	[-.19; .36]
X → M_1 → Y	**-.29**	**[−.43, −.18]**	**-.26**	**[−.13, .37]**	**-.35**	**[−.52, -.20]**
X → M_2 → Y	**.49**	**[.32, .68]**	**.43**	**[.23, .63]**	**.49**	**[.29, .71]**
X → M_1 → M_2 → Y	**-.05**	**[-.10, -.01]**	**-.04**	**[-.09 -.01]**	**-.05**	**[-.10 -.01]**

Overall Findings

The relation between idea novelty and the outcome variables (i.e., the expected success of ideas, endorsing their implementation, and their added value as a starting point for idea generation) was indeed serially mediated by all four elements of the ideas (i.e., perceived novelty, positive surprise, expected low feasibility, and disruptiveness), and subsequently, by the perceived creativity of the ideas (see the $X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$ results in Table 5). Whereas perceived novelty and positive surprise positively contributed to the indirect effects, low expected feasibility and disruptiveness negatively contributed to these effects. The specific paths are described below and visualized in Figure 1b, p. 24.

Through Perceived Novelty. The pattern of results through perceived novelty was similar for each outcome variable ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$ in Table 5). Novel ideas were also perceived as such ($X \rightarrow M_1$ = 1.73, 95% CI: [1.51; 1.95]), which positively predicted perceived creativity ($M_1 \rightarrow M_2$ = .78, 95% CI: [.69; .86]). This positively predicted the outcome variables: increasing the expected success of novel ideas, the endorsement of implementation, and their added value as a starting point for idea generation ($M_2 \rightarrow Y$ in Table 5).

The total indirect effects, moving from novel ideas to the outcome variables (success, implementation, and idea generation) via the element of perceived novelty, and subsequently perceived creativity, were positive or non-significant (see Table 5). The direct effect from novel ideas to the outcome variables (success, implementation, and idea generation) was negative (X → Y in Table 5).

Through Expected Low Feasibility. The pattern of results through perceived feasibility was similar for each outcome variable ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$ in Table 5). Novel ideas were perceived as less feasible ($X \rightarrow M_1$ = -1.49, 95% CI: [-1.72; -1.27]), which in turn affected perceived creativity and the outcome variables (the expected success,

implementation, and idea generation). Feasibility positively predicted perceived creativity ($M_1 \rightarrow M_2$ = .24, 95% CI: [.12; .37]), and perceived creativity subsequently positively predicted the outcome variables ($M_2 \rightarrow Y$ in Table 5).

The total indirect effects, moving from novel ideas to the outcome variables related to implementation (i.e., success and implementation) via the element of feasibility, and subsequently perceived creativity, were negative. However, when the idea was assessed as a starting point for further idea generation, the indirect effect via feasibility was non-significant. The direct effect from idea novelty to the outcome variables was negative (X → Y in Table 5).

Through Positive Surprise. The pattern of results through positive surprise was similar for each outcome variable ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$ in Table 5). Novel ideas were perceived as positively surprising ($X \rightarrow M_1$ = .81, 95% CI: [.58; 1.05]), which positively predicted perceived creativity ($M_1 \rightarrow M_2$ = .41, 95% CI: [.30; .51]). This positively predicted the outcome variables: increasing the expect success of novel ideas, the endorsement of implementation, and their added value as a starting point for idea generation ($M_2 \rightarrow Y$ in Table 5).

The total indirect effects, moving from novel ideas to the outcome variables (success, implementation, and idea generation) via the element of positive surprise, and subsequently perceived creativity, were positive. In contrast, the direct effect from novel ideas to the outcome variables was negative (X → Y in Table 5).

Through Disruptiveness. The pattern of results through perceived disruptiveness was similar for each outcome variable ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$ in Table 5). Novel ideas were perceived as more disruptive ($X \rightarrow M_1$ = .79, 95% CI: [.54; 1.04]), and disruptiveness negatively predicted perceived creativity ($M_1 \rightarrow M_2$ = -.17, 95% CI: [-.28; -.06]), which lowered the expected success of novel ideas, the endorsement of implementation, and the

added value as a starting point for idea generation ($M_2 \rightarrow Y$ in Table 5).

The total indirect effects, moving from novel ideas to the outcome variables (success, implementation, and idea generation) via the element of disruptiveness, and subsequently perceived creativity, were not significant. The direct effect from novel ideas to the outcome variables was negative (X → Y in Table 5).

Discussion Study 2

The results of this study are consistent with those of Study 1, in that novel ideas were perceived as novel and positively surprising, but also as less feasible and disruptive, which subsequently either positively or negatively affected their perceived creativity. In turn, each of these elements predicted the expected success of ideas, participants' willingness to endorse implementation, and the perceived value of ideas as a starting point for idea generation. The elements of perceived novelty and positive surprise positively contributed to these outcome variables. The expected low feasibility and high disruptiveness of novel ideas negatively affected these outcomes. Although we had expected that people would be more positive towards novel ideas when investigating them as a useful starting point for idea generation, compared with thinking of their immediate implementation, this difference only emerged for the element of feasibility. The element of feasibility indeed seemed less important when assessing or supporting creative ideas as a starting point for further idea generation rather than assessing the ideas for implementation.

Whereas novelty is the most important element for creativity, the direct effects of novel ideas on success, implementation, and idea generation were all negative. It may thus indeed be that recognizing the creative potential in novel ideas forms a prerequisite for implementing, investigating, or further developing these promising ideas (De Jonge et al., 2018) into useful and innovative products or materials (West, 2002; Zhou et al., 2016). We

conducted a third study to test whether we could replicate and generalize these findings in a different population of people working in creative industries.

Method Study 3

Sample, Design, and Procedure

A third experiment was conducted to test whether we could replicate the findings from Studies 1 and 2 with a sample of experts: that is, participants working in creative industries. The participants took part in an online Prolific Academic study. Using prescreening options, participants were invited who worked in the sectors of arts, design, entertainment, and recreation, graphic design, or product development. They participated voluntarily for an incentive (£1). Of the total of 253 participants, 31 participants were dropped from all analyses as their data were unreliable. We used the same exclusion criteria as before.[1] Participants were randomly assigned to assess ideas that were either high or low in normative novelty, and which were framed as input from a colleague. This resulted in two conditions: non-novel ideas (n = 104) and novel ideas (n = 118). Their ages ranged between 18 and 66 years (M = 33.59, SD = 11.04). Most of the participants were native English speakers (79%). Most worked in the arts (25%), followed by no paid job (23%), entertainment, travel, and recreation (14%), and communication and media (7%). The same procedure and materials as in Study 2 were used.

Results Study 3

Descriptives, correlations, and Cronbach's alphas of all variables are given in Table 6. The highest correlations were obtained for endorsing implementation with expected success (.78, p < .001), and feasibility (.69, p < .001). High correlations were also obtained for perceived novelty with condition (.67, p < .001) and with perceived creativity (.78, p < .001).

Table 6. *Descriptives, Correlations, and Cronbach's Alphas – Study 3*

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1. Gender	NA	NA	NA										
2. Age	33.59	11.04	.12†	NA									
3. Condition	NA	NA	.06	.09	NA								
4. Perceived Novelty	2.71	1.20	.02	.03	.67**	(.91)							
5. Pos. Surprise	1.79	.92	-.02	-.02	.35**	.62**	(.92)						
6. Exp. Low Feasibility	2.70	1.06	-.07	-.04	-.65**	-.41**	-.16*	(.92)					
7. Disruptiveness	1.99	1.06	-.06	-.09	.27**	.13	.04	-.56**	(.88)				
8. Perc. Creativity	2.67	.95	-.01	.04	.51**	.78**	.63**	-.12†	-.06	(.75)			
9. Success	2.57	.98	-.02	-.05	-.38**	-.12†	.16*	.61**	-.54**	.13†	(.77)		
10. Implementation	2.45	1.06	-.06	-.04	-.47**	-.17*	.21**	.69**	-.52**	.07	.78**	(.95)	
11. Idea Generation	3.28	1.08	-.05	-.07	-.20**	.07	.26**	.46**	-.48**	.22**	.55**	.59**	(.91)

Note. $n = 222$. † $p < .10$; * $p < .05$; ** $p < .01$. When applicable, the corresponding Cronbach's alpha is displayed on the diagonal.

Gender coded as 1 for male and 2 for female. Condition coded as 1 for non-novel and 2 for novel ideas.

As expected, participants on the whole perceived novel ideas as more creative than non-novel ideas ($M_{\text{non-novel}} = 2.16$ vs $M_{\text{novel}} = 3.12$, $F(1, 221) = 75.19$, $p < .001$). Regarding the outcome variables, participants were somewhat more positive about the presented ideas as a starting point for further idea generation ($M = 3.28$) than in terms of direct implementation ($M = 2.45$) or success ($M = 2.57$). Sex and age were evenly distributed across conditions ($\chi^2_{\text{sex}}(1, N = 222) = .75$ $p = .39$; $F_{age}(1, 222) = 1.67$, $p = .20$ ($M_{non\text{-}novel\ ideas} = 32.57$ vs $M_{novel\ ideas} = 34.48$).

Hypothesis Testing

Similarly to Study 2, we used Hayes' (2013) PROCESS SPSS macro (model 6), with a bootstrapping sample size of 5000, to test the sequential mediation model that idea novelty would predict the expected success of ideas, willingness to endorse implementation, and the added value as a starting point for idea generation through the proposed mediators, as depicted in Figure 1b, p. 24.

Overall Findings

The pattern of results was identical to Study 2. The relation between idea novelty and the outcome variables (i.e., the expected success of ideas, willingness to endorse implementation, and the added value as a starting point for idea generation) was again serially mediated by all four elements of the ideas (i.e., perceived novelty, positive surprise, expected low feasibility, and disruptiveness), and, subsequently, by the perceived creativity of the ideas (see the $X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$ results in Table 7). Whereas the elements of perceived novelty and positive surprise positively contributed to the indirect effects, the expected low feasibility and disruptiveness negatively contributed to these effects. The specific paths are described below and visualized in Figure 1b, p. 24.

Table 7. *Bootstrap Results for each of the Mediators and Outcome Variables – Study 3*

	Expected success		Implementation		Idea generation	
Perceived Novelty	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect, X → Y	**-1.03 (.15)**	**[-1.33; -.74]**	**-1.36 (.16)**	**[-1.67; -1.05]**	**-.93 (.18)**	**[-1.28; -.58]**
$M_2 \rightarrow Y$	**.57 (.09)**	**[.38; .76]**	**.53 (.09)**	**[.34; .73]**	**.46 (.11)**	**[.24; .69]**
Total indirect effect	**.28 (.12)**	**[.07; .53]**	**.35 (.12)**	**[.12; .60]**	**.50 (.14)**	**[.22; .79]**
$X \rightarrow M_1 \rightarrow Y$	**-.26 (.13)**	**[-.52; -.02]**	-.16 (.14)	[-.46; .11]	.05 (.20)	[-.34; .44]
$X \rightarrow M_2 \rightarrow Y$	-.04 (.06)	[-.17; .09]	-.04 (.06)	[-.17; .08]	-.03 (.06)	[-.16; .07]
$X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$	**.59 (.11)**	**[.39; .83]**	**.33 (.13)**	**[.33; .82]**	**.48 (.15)**	**[.20; .80]**
Positive Surprise						
Direct effect, X → Y	**-1.19 (.13)**	**[-1.44; -.93]**	**-1.47 (.13)**	**[-1.73; -1.22]**	**-.92 (.15)**	**[-1.22; -.62]**
$M_2 \rightarrow Y$	**.34 (.08)**	**[.18; .51]**	**.25 (.08)**	**[.08; .41]**	**.33 (.10)**	**[.14; .52]**
Total indirect effect	**.44 (.09)**	**[.28; .65]**	**.47 (.10)**	**[.29; .68]**	**.49 (.11)**	**[.29; .72]**
$X \rightarrow M_1 \rightarrow Y$	**.11 (.06)**	**[.00; .25]**	**.23 (.07)**	**[.11; .39]**	**.17 (.08)**	**[.06; .36]**
$X \rightarrow M_2 \rightarrow Y$	**.21 (.06)**	**[.11; .34]**	**.15 (.06)**	**[.05; .27]**	**.20 (.08)**	**[.06; .36]**
$X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$	**.12 (.04)**	**[.06; .19]**	**.08 (.03)**	**[.03; .15]**	**.11 (.05)**	**[.03; .21]**

Note. If CI does not include zero, the effect is considered statistically significant and is displayed in bold. $n = 222$.

Table 7 (Continued). *Bootstrap S for each of the Mediators and Outcome Variables – Study 3*

	Expected success		Implementation		Idea generation	
Expected Low Feasibility	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect, X → Y	**-.36 (.16)**	**[-.68; -.04]**	**-.49 (.16)**	**[-.80; -.17]**	-.12 (.20)	[-.51; .27]
M_2 → Y	**.30 (.06)**	**[.17; .42]**	**.28 (.06)**	**[.15; .41]**	**.34 (.08)**	**[.19; .50]**
Total indirect effect	**-.39 (.17)**	**[-.70; -.05]**	**-.52 (.18)**	**[-.88; -.15]**	-.31 (.18)	[-.67; .05]
X → M_1 → Y	**-.67 (.11)**	**[-.89; -.47]**	**-.79 (.13)**	**[-1.05; -.55]**	**-.64 (.13)**	**[-.90; -.41]**
X → M_2 → Y	**.42 (.11)**	**[.22; .65]**	**.40 (.11)**	**[.18; .63]**	**.48 (.13)**	**[.23; .76]**
X → M_1 → M_2 → Y	**-.13 (.04)**	**[-.22; -.06]**	**-.13 (.04)**	**[-.22; -.05]**	**-.15 (.06)**	**[-.28; -.06]**
Disruptiveness						
Direct effect, X → Y	**-.86 (.12)**	**[-1.10; -.61]**	**-1.15 (.13)**	**[-1.41; -.89]**	**-.56 (.15)**	**[-.86; -.27]**
M_2 → Y	**.34 (.06)**	**[.22; .46]**	**.36 (.06)**	**[.23; .49]**	**.37 (.08)**	**[.22; .52]**
Total indirect effect	.11 (.10)	[-.08; .32]	.14 (.12)	[-.09; .38]	.13 (.13)	[-.13; .38]
X → M_1 → Y	**-.22 (.05)**	**[-.32; -.12]**	**-.20 (.06)**	**[-.32; -.10]**	**-.23 (.07)**	**[-.37; -.11]**
X → M_2 → Y	**.36 (.08)**	**[.22; .53]**	**.38 (.09)**	**[.22; .57]**	**.40 (.10)**	**[.21; .60]**
X → M_1 → M_2 → Y	**-.04 (.02)**	**[-.08; -.01]**	**-.04 (.02)**	**[-.08; -.01]**	**-.04 (.02)**	**[-.09; -.01]**

Through Perceived Novelty. The pattern of results through perceived novelty was similar for each outcome variable ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$ in Table 7). Novel ideas were also perceived as such ($X \rightarrow M_1$ = 1.62, 95% CI: [1.38; 1.85]), which positively predicted their perceived creativity ($M_1 \rightarrow M_2$ = .64, 95% CI: [.55; .73]). This positively predicted the outcome variables: increasing the expected success of novel ideas, the endorsement of implementation, and the added value as a starting point for idea generation ($M_2 \rightarrow Y$, Table 7).

The total indirect effects, moving from novel ideas to the outcome variables (success, implementation, and idea generation) via the element of perceived novelty, and subsequently perceived creativity, were positive (see Table 7). The direct effect from novel ideas to the outcome variables (success, implementation, and idea generation) was negative (X → Y in Table 7).

Through Expected Low Feasibility. The pattern of results through perceived feasibility was similar for each outcome variable ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$ in Table 7). Novel ideas were perceived as less feasible ($X \rightarrow M_1$ = -1.39, 95% CI: [-1.60; -1.17]), which in turn affected their perceived creativity and outcome variables (the expected success, implementation, and idea generation). Feasibility positively predicted perceived creativity ($M_1 \rightarrow M_2$ = .33, 95% CI: [.20; .45]), and perceived creativity in turn positively predicted the outcome variables ($M_2 \rightarrow Y$ in Table 7).

The total indirect effects, moving from novel ideas to the outcome variables related to implementation (i.e., success and implementation) via the element of feasibility, and subsequently perceived creativity, were negative. However, when the idea was assessed as a starting point for further idea generation, the indirect effect via feasibility was non-significant. The direct effect from novel ideas to the outcome variables was also negative for success and implementation, but non-significant for idea generation (X → Y in Table 7).

Through Positive Surprise. The pattern of results through positive surprise was similar for each outcome variable ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$ in Table 7). Novel ideas were perceived as positively surprising ($X \rightarrow M_1$ = .64, 95% CI: [.41; .87]), which positively predicted their perceived creativity ($M_1 \rightarrow M_2$ = .54, 95% CI: [.43; .64]). This in turn positively predicted the outcome variables: increasing the expected success of novel ideas, the endorsement of implementation, and the added value as a starting point for idea generation ($M_2 \rightarrow Y$ in Table 7).

The total indirect effects, moving from novel ideas to the outcome variables (success, implementation, and idea generation) via the element of positive surprise, and subsequently perceived creativity, were positive. The direct effect from novel ideas to the outcome variables was negative (X → Y in Table 7).

Through Disruptiveness. The pattern of results through disruptiveness was similar for each outcome variable ($X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$ in Table 7). Novel ideas were perceived as more disruptive ($X \rightarrow M_1$ = .57, 95% CI: [.30; .84]), and disruptiveness negatively predicted perceived creativity ($M_1 \rightarrow M_2$ = -.18, 95% CI: [-.29; -.08]), which lowered the expected success of novel ideas, the endorsement of implementation, and the added value as a starting point for idea generation ($M_2 \rightarrow Y$ in Table 5).

The total indirect effects, moving from novel ideas to the outcome variables (success, implementation, and idea generation) via the element of disruptiveness, and subsequently perceived creativity, were not significant. The direct effect from novel ideas to the outcome variables was negative (X → Y in Table 7).

General Discussion

In the present research, we investigated what constitutes a creative idea, why, and for whom, and for doing what. Focusing on *what* constitutes a creative idea and *why*, we expected and found that both wanted (i.e., perceived novelty and positive surprise) and unwanted elements (i.e., expected low feasibility and disruptiveness) made an important contribution to the perceived creativity of novel ideas. Whereas perceived novelty and positive surprise contributed to the perception of novel ideas as creative, their expected low feasibility and disruptiveness lowered this perception. These findings indicate that the common definition of creativity being ideas that are both novel and feasible (Runco & Jaeger, 2012; Stein, 1953) does not fully cover people's perception of what constitutes a creative contribution. That is, perceptions of creativity also seem to imply some sort of valuation or appreciation of the idea (Runco & Smith, 1992). Participants in our studies perceived novelty and feasibility as inversely related, and additionally incorporated positive surprise and disruptiveness as independent characteristics of creativity. These findings also support our notion that novel ideas open up new possibilities that have wanted and unwanted elements, which differently affect perceptions of creativity.

Additionally, we investigated *for whom* these perceptions of creativity hold, and *for doing what*. As expected, perceptions of creativity were constituted similarly for laypeople and experts, that is, people in creative industries. The indirect sequential relations between idea novelty and endorsement outcomes indicated that idea novelty was positively related to the wanted elements of perceived novelty and positive surprise. These were positively related to perceived creativity, and, in turn, positively related to the expected success of novel ideas, the willingness to endorse implementation, and the perceived added value for further idea generation. In contrast, idea novelty was associated with low feasibility. This unwanted element was negatively related to perceived creativity, and, in turn, negatively related to the

endorsement outcomes. These relations underline that creativity is indeed valued in accordance with the extent to which it advances doing. Disruptiveness also negatively affected perceived creativity, but it was unclear whether this, in turn, affected perceived success, endorsement for implementation, and further idea generation. Furthermore, only when the expected feasibility of the novel idea was low were people less positive towards novel ideas in the context of end products rather than starting points for idea generation. No such effects were found for perceived novelty, positive surprise, and disruptiveness.

Strengths & Limitations

One of the strengths of this research is the consistency of the results: Despite the complexity of the model, the three studies show virtually identical results, even across different samples (i.e., laypeople and experts). Also, our results are consistent with earlier work showing that highly novel ideas are seen as more novel, but less feasible (see e.g., Litchfield et al., 2015; Rietzschel et al., 2010). Further, the fact that both novelty and feasibility positively contributed to participants' perceptions of creativity is in line with the common definition of creativity (Runco & Jaeger, 2012; Stein, 1953), although our results suggest that there may be more to it than that.

Focusing on the indirect serial relations of our full theoretical model, we found that perceived creativity played a key role in the expected success of novel ideas, the willingness to endorse implementation, and the perceived added value for further idea generation. This adds to previous research indicating that recognizing the creative potential in novel ideas forms a prerequisite to using these ideas for further idea generation (De Jonge et al., 2018), and to investigating and further developing these promising initial ideas into useful and innovative products or materials (West, 2002; Zhou et al., 2016).

The successful replications and the consistency of our findings strengthen our confidence in the current data. Our goal in investigating both laypeople and people in creative

industries was to test if perceptions of creativity are constituted similarly within these two groups, which indeed appeared to be the case. However, to further enhance replication and generalizability, future research could investigate additional samples. For example, the sample of creative industries could be further specified, by specifically including those who regularly create or evaluate creative ideas. Our results indicated that perceptions of creativity were formed similarly by laypeople and by experts working in creative industries, and we would expect similar results when further specifying the latter group. However, "the skills necessary for creative art, for example, are different from those necessary for creative mathematics, science, or organizational management (Runco & Smith, 1992, p. 295)." Although we focused on perceptions of creativity rather than creative skills, perhaps it differs per creative industry how novel ideas are perceived and what elements underlie these perceptions. At the same time, most research indicates moderate to strong agreement in evaluations of creativity between experts in different domains (Amabile, 1996; Baer, Kaufman, & Gentile, 2004; Kaufman et al., 2013).

Theoretical Implications and Future Directions

Although our results add to our understanding of how perceptions of creativity are formed, more research is obviously needed. Clearly, perceptions of creativity are much more complex than a combination of novelty and feasibility, but their exact dimensions, their relative weight, their importance for different kinds of outcomes, and the possible role of group or individual differences need to be investigated further. For example, future research is needed to replicate our finding that creativity is valued according to the extent to which the idea advances doing, either in immediate implementation, or in further idea generation and elaboration. Also, future research could test if and how well people are actually able to use novel ideas as starting points for further idea generation (see also, De Jonge et al., 2018). Recognizing the creativity and the added value of ideas is an important first step in the

cognitive stimulation process. Although recognizing creativity revolves around the perception of other people's ideas, whereas cognitive stimulation concerns generating ideas oneself, the two processes are strongly interrelated. For example, Zhou and colleagues (2016) argued that the recognition of an idea's novelty is crucial for its potential to further stimulate the creative process, and previous research indicates that recognizing creativity is linked to the stimulating potential of the ideas (De Jonge et al., 2018; Gawronski & Bodenhausen, 2006; Zhou et al., 2016). Also, ideas that score high on richness, in the sense of triggering further idea generation, are perceived as more creative (Sosa & Dong, 2013). Based on this, we would expect that ideas are perceived as more creative when they activate a greater number of relevant ideas in one's mind. This in turn would result in higher levels of cognitive stimulation.

Next, given that we do not know up front whether a novel idea will indeed be useful and result in innovation, developing and testing novel ideas may require a trial and error process in the form of "blind variation and selective retention" (Campbell, 1960, p.380). Hence, creating and developing new ideas may require some form of risk-taking by the creator, feeling more at ease to risk failure (Simonton, 2018). Related to this, previous research indicates that feelings of uncertainty and the motivation to reduce uncertainty can activate a creativity bias. This bias activates more negative associations with creativity, and results in lower evaluations of creative ideas (Mueller et al., 2012). Future research is needed to test whether risk-taking is indeed positively related to the evaluation, implementation, and further development of novel ideas.

Also, whereas the current studies focused on creativity perceptions of interpersonal ideas, such perceptions may differ when evaluating intrapersonal ideas. As explained by Runco and Smith (1992), this may be because the creator of an idea has more knowledge of the associative history of the idea and is aware of the complete picture that the idea originated

from. Also, the creator knows of the other ideas that were rejected and why the current ideas where kept, and knows how ideas were further developed. An observer who receives ideas, will investigate the idea based on its own characteristics, without having the full picture or knowing what other ideas were generated but rejected or adapted in the process. On the one hand, not having such information could enable the observer to investigate the characteristics of the idea more objectively. On the other hand, not having the full picture of where ideas originated from may (unnecessarily) strengthen perceptions of disruptiveness, as novel ideas are often less closely related to one's own mental images or to one's perspective on the topic at hand (Dugosh & Paulus, 2005). Future researchers could investigate whether creativity perceptions indeed differ for interpersonal and intrapersonal ideas.

Practical Implications

The identification of novel ideas as creative is key to new product development and innovation (Katila, 2002; Maggitti, Smith, & Katila, 2013; Tidd & Bodley, 2002). Our findings indicate that novel ideas open up new possibilities that have wanted and unwanted elements, which either positively or negatively affect perceptions of creativity. Because of this, it is important for research and practice to be aware that novel ideas are not valued in all respects. Rather, novel ideas are automatically perceived as non-feasible and disruptive. This is probably because novel ideas by definition imply risk and uncertainty, which may explain why organizations find it difficult to endorse creative ideas even when these are desired and required (Mueller et al., 2014; Staw, 1995). When communicating new ideas to relevant others, it may therefore be helpful to make explicit why these ideas are not disruptive or unfeasible, relating them to similar examples in one's own or another field. Alternatively, it may help to indicate why the current lack of feasibility does not have to be a problem. Seeing the idea as raw material for further development may help people to refrain from immediate evaluation or rejection of such ideas owing to their (in)feasibility. Making the revision and

development of ideas a fundamental part of idea selection (see also, Lonergan, Scott, & Mumford, 2004) can help to increase willingness to adapt and refine novel ideas to make them implementable, and valuable as well (Litchfield et al., 2015). This in turn increases the likelihood that organizations and teams can benefit from the novel ideas generated.

Conclusion

The identification of novel ideas as creative is key to new product development and innovation, but little is known of what constitutes a creative idea, why, and for whom, and for doing what. The findings of the current studies indicate that both wanted (i.e., perceived novelty and positive surprise) and unwanted elements (i.e., expected low feasibility and disruptiveness) make an important contribution to the perceived creativity of novel ideas. These elements either positively or negatively affect perceptions of creativity, in turn affecting the expected success of novel ideas, the willingness to endorse implementation, and the perceived added value as a starting point for idea generation. This underlines our notion that wanted and unwanted elements are inherently associated with new ideas and new possibilities, and that creativity is valued by both laypeople and experts to the extent to which it advances doing.

Footnotes

[1]Data was not included in case of: a recurring IP-addresses (Study1: $n = 3$, Study 2: $n = 0$, Study 3: $n = 0$), indicating not responding carefully to questions (Study1: $n = 12$, Study 2: $n = 20$, Study 3: $n = 13$) or that we should not use their data (Study1: $n = 2$, Study 2: $n = 2$, Study 3: $n = 2$). Further, as a means to further ensure proper participation, we investigated the mean participation length (Study1: 12.09 minutes, Study 2: 10.93, Study3: 12.75) and included those participants between the 5th – 95th percentile. For Study 1, we hence left out participants that participated less than 8 ($n = 14$) or more than 20 ($n = 10$) minutes. For Study 2, participants that participated less than 5 ($n = 0$) or more than 21 ($n = 8$) minutes. And for Study 3, participants that participated less than 6 ($n = 8$) or more than 21 ($n = 8$) minutes.

[2]Exploratively, we included the framing conditions. The results obtained indicated no difference in outcomes when using the framing as general ideas or specific input: no main effect (b = -.09, 95% CI: [-.33; .14]) and no interaction effect with (non-)novel stimuli (F (1, 153) = 1.12, $p = .29$]). For sake or clarity and comprehensibility, we therefore do not further zoom in on the framing conditions.

[3]For the novel condition, ideas were selected that were rated ≥4 (on a 5-point scale) on novelty, for the non-novel condition, ideas were selected that were rated ≤2 on novelty. Feasibility was held constant at a moderate level in both conditions, with an average of 3.25 on a 5-point scale.

3

Stimulated by Novelty?

The role of Psychological Needs and Perceived Creativity

In the current research we aimed to address the inconsistent finding in the brainstorming literature that cognitive stimulation sometimes results from novel input, yet other times from non-novel input. We expected and found, in three experiments, that the strength and valence of this relationship is moderated by people's psychological needs for structure and autonomy. Specifically, the effect of novel input (vs. non-novel input), through perceived creativity, on cognitive stimulation was stronger for people who were either low in need for structure or high in need for autonomy. Also, when the input people received did not fit their needs, they experienced less psychological cognitive stimulation from this input (i.e., less task enjoyment and feeling more blocked) compared with when they did not receive any input. Hence, to create the ideal circumstances for people to achieve cognitive stimulation when brainstorming, input novelty should be aligned with their psychological needs.[4]

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[4] This Chapter is based on De Jonge, K. M. M., Rietzschel, E. F., & Van Yperen, N. W. (2018). Stimulated by Novelty? The Role of Psychological Needs and Perceived Creativity. *Personality and Social Psychology Bulletin*, *44*(6), 851–867. http://doi.org/10.1177/0146167217752361

CHAPTER 3

Stimulated by Novelty?

The role of Psychological Needs and Perceived Creativity

People often work together on a variety of tasks, including idea generation in brainstorming sessions (Chirumbolo, Mannetti, Pierro, Areni, & Kruglanski, 2005; Nijstad, Stroebe, & Lodewijkx, 2006). In brainstorming groups, members contribute different knowledge, expertise, and opinions. Receiving input from others can be cognitively stimulating and result in more and better ideas than individual idea generation (Paulus & Coskun, 2013), but can also be interfering and interrupt one's own thought process, hence resulting in suboptimal performance (Diehl & Stroebe, 1987; Nijstad & Stroebe, 2006).

The degree to which sharing of ideas results in cognitive stimulation depends on factors such as the attention given to these ideas and the type of ideas shared, including their semantic diversity and novelty (Dugosh & Paulus, 2005; Nijstad, Stroebe, & Lodewijkx, 2002). So far, research focusing on input novelty has found inconsistent results, sometimes indicating that novel input rather than non-novel input increases cognitive stimulation (e.g., Berg, 2014), other times indicating the opposite (e.g., Dugosh & Paulus, 2005). The present research adds to the literature by arguing and demonstrating that the strength and valence of the link between input novelty and cognitive stimulation partly depend on people's psychological needs for structure and autonomy. Additionally, we propose that the perceived creativity of the input mediates this relationship, in line with previous research indicating that the role of novelty in the perception of creativity is less than straightforward (e.g., Mueller, Wakslak, & Krishnan, 2014). Moreover, we extend the definition and measurement of cognitive stimulation by including both performance and psychological factors as components. We discuss this below.

Cognitive Stimulation in Group Brainstorming

Usually, brainstorming groups perform below their potential as a result of production blocking (Diehl & Stroebe, 1987; Lamm & Trommsdorff, 1973; Nijstad & Stroebe, 2006). Being exposed to other group members' ideas can interfere with one's own idea generation process simply because one typically has to wait for another group member to stop talking before being able to contribute one's own idea. Furthermore, monitoring others' input may lead to cognitive interference, resulting in less effective idea generation (Diehl & Stroebe, 1991; Nijstad, 2000). Nevertheless, one important reason for working together on brainstorming tasks is the potential for *cognitive stimulation*: Being exposed to other people's ideas might enhance one's own idea generation process (e.g., Nijstad & Stroebe, 2006).

Previous research has focused on *performance components* of cognitive stimulation, such as *productivity* and *idea diversity*. When people are exposed to other people's ideas, the features of the input are used to increase *productivity* by generating new ideas through combining knowledge and forming new associations. Indeed, previous findings indicate that when group members exchange and collectively process information, the group has the potential, at least in theory, to perform better than the sum of its parts (i.e., all individuals separately) (e.g., De Dreu, Nijstad, & van Knippenberg, 2008; Hinsz, Tindale, & Vollrath, 1997). Group brainstorming may increase *idea diversity* because group members can contribute different knowledge, expertise, and opinions to the group, which may trigger new ideas or areas of knowledge in one's own mind that would not be as easily activated without some external cue (Brown, Tomeo, Larey, & Paulus, 1998; Dugosh, Paulus, Roland, & Yang, 2000; Nijstad & Stroebe, 2006).

We extend the definition of cognitive stimulation by suggesting that it also entails *psychological components*: namely, *task enjoyment* and *reduced feelings of being blocked.* We expect high levels of *task enjoyment*, because the feeling of being able to use others' ideas

is likely to be valued positively and increase intrinsic motivation (Amabile, 1983). Also, *reduced feelings of being blocked* by the input are expected because input that is cognitively stimulating is likely to be perceived as helpful for idea generation. Indeed, previous research indicates that people are generally more satisfied and perceive idea generation as easier when brainstorming in groups compared with brainstorming individually (Nijstad & Stroebe, 2006; Nijstad et al., 2006). An important factor explaining this finding is the feeling that group brainstorming results in fewer failures to generate ideas, as the group together is able to continue generating input even at moments when the individual is unable to come up with an idea. Further, people tend to believe that group brainstorming is very effective, because they ascribe the reduction of failures to the stimulating effect of receiving other people's ideas (Nijstad et al., 2006). Three variables that may explain whether others' input cognitively stimulates rather than interferes are input novelty, the individual's psychological needs, and perceived creativity.

Input Novelty and Cognitive Stimulation

The extent to which cognitive stimulation occurs partly depends on characteristics of the input ideas, including idea novelty (Dugosh & Paulus, 2005). Although one might intuitively expect that idea novelty enhances cognitive stimulation (see, for example, Connolly, Routhieaux, & Schneider, 1993), its role appears to be complex: Some findings suggest that novelty increases cognitive stimulation, whereas other findings suggest the opposite.

Kohn, Paulus, and Choi (2011) found that brainstorming groups were more likely to come up with novel combinations of ideas when they had been presented with rare (as opposed to common) ideas. Also, findings by Berg (2014) indicate that exposing people to new ideas stimulates the production of novel ideas. Additionally, Agogué and colleagues (2013) found that presenting people with unusual (as opposed to common) solutions improved

original problem solving. They argue that presenting common solutions results in a fixation on common knowledge and hence in usual rather than novel solutions. This fixation effect is in line with findings by Perttula and Sipilä (2007), who found that use of common examples (as opposed to novel examples) when brainstorming causes more fixation and results in reproduction of features of the examples presented.

In contrast to these findings, Dugosh and Paulus (2005) found that participants' productivity in a brainstorming task was stimulated most when participants were presented with a large number of highly common, conventional ideas as opposed to unique, novel ideas. They argue that common ideas are likely to be closely related to one's own mental images, creating the greatest opportunity to elicit ideas associated with the input. Additionally, Connolly and colleagues (1993) found (in contrast to their expectation) that common rather than rare input stimulated more novel idea generation. Kohn and Smith (2011) found that participants exposed to a low number of common categories generated more novel ideas than those exposed to novel categories. Finally, Fink and colleagues (2010) found that people generated more original responses when receiving common rather than nonsense input, but found no stimulation effect of novel input. They suggest that novel input is highly complex to process and makes it difficult for participants to keep up with the generation of ideas at the same level of those presented.

The complex role of input novelty in the creative process raises the question of which factors could affect whether or not novel input during brainstorming is perceived as creative (cf. Zhou, Wang, Song, & Wu, 2017) and hence leads to cognitive stimulation. We extend the literature by indicating that the (mis)fit between input novelty and the individual's psychological needs moderates this link (see also Figure 1 for our theoretical model, p. 62). Individual needs are important predictors and moderators in the context of creative performance, work motivation, and group interactions (e.g., Chirumbolo et al., 2004; Deci &

Ryan, 2000; Van Yperen, Wörtler, & De Jonge, 2016). In the current research, we focused on need for structure and need for autonomy, because these independent needs form a dynamic duo, often relating to opposing outcomes within the same context. For example, autonomous situations characterized by freedom fit well with the need for autonomy, but are not beneficial for those high in need for structure, as such situations often imply a lack of structure (Rietzschel, 2015; Slijkhuis, Rietzschel, & Van Yperen, 2013). In fact, people high in need for structure prefer a predetermined task structure over high autonomy (Rietzschel, Slijkhuis, & Van Yperen, 2014). Moreover, findings on group performance and group creativity suggest that the way people attend to and make use of others' input depends on both epistemic (such as need for structure) and social motives (such as need for autonomy) (De Dreu et al., 2008). As explained below, different levels of cognitive stimulation are to be expected for these psychological needs when people receive input high versus low in novelty, with novel input being less beneficial for those high in need for structure as well as for those low in need for autonomy.

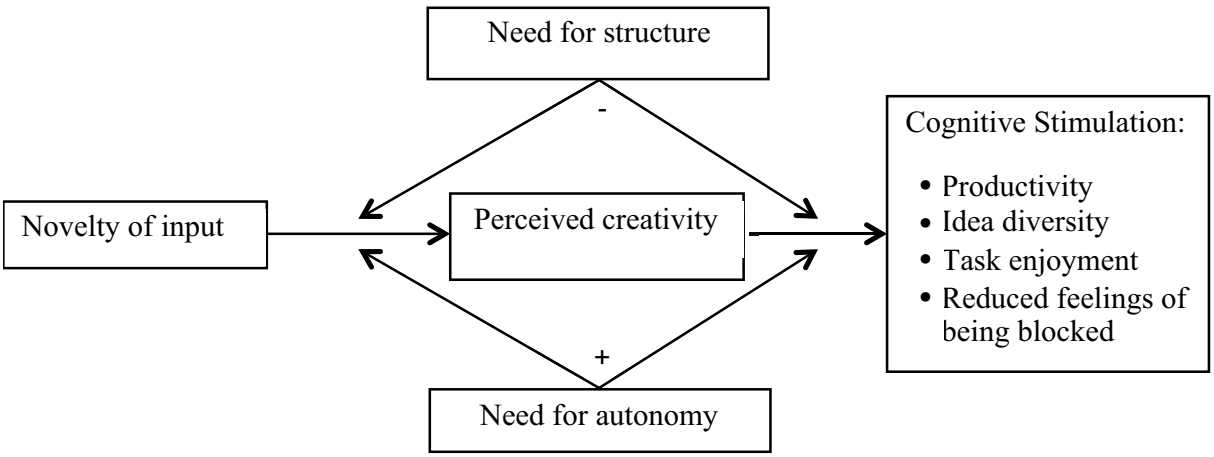

Figure 1. Theoretical model. Cognitive stimulation as an indirect function of input novelty, mediated by perceived creativity, and moderated by need strengths (i.e. need for structure and need for autonomy).

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Cognitive Stimulation and Need for Structure

People high in need for structure have a strong preference for clarity and predictability, an aversion to extensive information processing, and a strong desire to diminish ambiguity and uncertainty (Neuberg & Newsom, 1993; Thompson, Naccarato, Parker, & Moskowitz, 2001). They perform worse in ambiguous task conditions, and tend to experience high levels of stress and discomfort when confronted with ill-structured situations that lack clarity (Beersma, De Dreu, Dalenberg, & Vogelaar, 2007). Hence, they tend to form and use simple cognitive structures (such as cognitive heuristics and schemas) with the aim of simplifying the environment into a manageable form (Neuberg & Newsom, 1993). Moreover, people with a high need for structure perform most creatively under conditions of clarity and focus (Rietzschel, De Dreu, & Nijstad, 2007; Rietzschel et al., 2014).

Research on need for structure and related epistemic needs (such as need for closure and uncertainty avoidance) suggests that such people will not respond very favorably to novel input during brainstorming. Novel input is surprising and forms a schema violation of one's own activated cognitive structures (Gocłowska, Baas, Crisp, & De Dreu, 2014). Also, it can make the task more complex and ambiguous (Fink et al., 2010), and requires more information processing (Förster, 2009). These aspects are disliked by those high in need for structure and make it difficult to understand and incorporate the input when brainstorming. Novel input is therefore likely to disrupt the idea generation process (Nijstad & Stroebe, 2006) and hence to lead to a sense of being blocked. Resulting from this, people high in need for structure are expected to experience high levels of being blocked when receiving novel input. Also, such schema violations impede their creative performance (Gocłowska et al., 2014).

All in all, people high in need for structure are not likely to value novel input as helpful or creative, and as a result, are expected not to be particularly stimulated by it. Rather,

these people are likely to respond more positively to less original ideas. Because non-novel input is easily recognized as highly relevant to the task and is more likely to resemble the ideas that the person has been generating (Dugosh & Paulus, 2005), it may reaffirm the task goal, thus increasing task clarity and lowering ambiguity. People with a high need for structure, who dislike the ambiguity and complexity associated with highly original ideas, may also be more motivated to attend to less original ideas, which is also an important precondition for cognitive stimulation effects (Dugosh et al., 2000). Common ideas may seem more valid (Stasser & Birchmeier, 2003) and result in the least cognitive resistance (Berg, 2014) – heuristics that people with a high need for structure may be especially likely to use. As common ideas are likely to be closely related to one's own semantic schemas, such input creates the greatest opportunity to elicit ideas associated with the input (Dugosh & Paulus, 2005). Given that people with a high need for structure prefer clarity, predictability, and certainty, non-novel input should fit their cognitive needs better than novel input. Thus, we expected that the effect of novel (vs. non-novel) input on cognitive stimulation would be stronger (vs. weaker) for people with a low need for structure than for people with a higher need for structure.

Cognitive Stimulation and Need for Autonomy

Besides the epistemic implications of the input one receives, the mere fact that ideas are shared and need to be attended to may be problematic for some people, especially those who desire freedom, independence, and individual discretion. Such people, who are high in *need for autonomy* (Deci & Ryan, 2000), prefer to be in control of their own actions and to decide on their own how and when to perform a task (Hackman & Oldham, 1976). They prefer task outcomes to depend on their own decisions, initiatives, and efforts, they dislike external instructions, and they show an aversion to external control (Van den Broeck, Vansteenkiste, De Witte, & Lens, 2008).

When brainstorming, people high in need for autonomy will probably perceive external input as controlling and interrupting their workflow, particularly when the ideas received are non-novel. The forced delay of having to attend to other people's ideas is an important component of production blocking (Diehl & Stroebe, 1987; Nijstad & Stroebe, 2006), and it is likely that this is especially annoying when receiving common input that does not seem to add anything new. This kind of non-novel input is likely to be perceived as having no added value for executing the task at hand (that is, the idea does not add anything that one could not have generated oneself), leaving only an unnecessary interruption and a form of external control. Such external control violates their need for autonomy, and this is known to lower intrinsic motivation and creativity (see e.g., Shalley, Zhou, & Oldham, 2004).

In contrast, receiving novel input is expected to attenuate these negative effects, because novel input adds a new and original perspective to the task at hand. Novel input may enhance people's flexibility and freedom in approaching the task, because it gives them more options to choose from. This line of reasoning fits with previous findings indicating that external control and constraints undermine creative performance, whereas intrinsic motivation (fueled by perceived autonomy) enhances creativity (e.g., Amabile, 1983). Thus, the effect of novel (vs. non-novel) input on cognitive stimulation should be stronger for people with a high need for autonomy than for people with a low need for autonomy.

The Role of Perceived Creativity

Besides addressing important moderators on the relation between input novelty and cognitive stimulation, we argue that these effects will be mediated by the *perceived creativity* of the input (see Figure 1, p. 62). Although recognizing creativity revolves around the perception of other people's ideas, whereas cognitive stimulation concerns generating ideas oneself, the two processes are strongly interrelated. For example, Zhou, Wang, Song, and Wu (2017) argue that the recognition of an idea's novelty is crucial for its potential to

further stimulate the creative process, and previous research indicates that recognizing creativity is linked to the stimulating potential of the input (Gawronski & Bodenhausen, 2006; cf. Zhou et al., 2017). Thus, the degree to which an idea activates associations that can stimulate idea generation is a function of the degree to which the idea is appreciated and seen as creative. Also, ideas that score high on richness, in the sense of triggering further idea generation, are perceived as more creative (Sosa & Dong, 2013). Based on this, we argue that input is perceived as more creative when it activates a higher amount of task-relevant associations in one's mind. This in turn should result in higher levels of cognitive stimulation. Hence, recognizing the creativity and the added value of input is an important first step in the cognitive stimulation process.

Yet, although generating and recognizing novelty clearly is at the heart of the creative process (Diedrich, Benedek, Jauk, & Neubauer, 2015; Runco & Charles, 1993; Zhou et al., 2017), people do not always respond favorably to novel ideas. They sometimes do not recognize (Mueller, Wakslak, & Krishnan, 2014) or appreciate creativity. In fact, people may have an implicit bias against creativity, even when they explicitly claim to find it valuable (Mueller, Melwani, & Goncalo, 2012). Other research also shows considerable variability in people's recognition of creative ideas (e.g., Herman & Reiter-Palmon, 2011; Silvia, 2008). In line with the previously discussed research, we anticipated that different psychological needs would result in different perceptions of the creativity of novel input.

Firstly, we expected that people high in need for autonomy would perceive novel ideas as more creative. Because novel input is surprising and can stimulate remote associations, and hence could help them generate new ideas (Kohn et al., 2011), they may be especially likely to perceive original and unusual input as a useful contribution to their own idea generation (see, for example, Connolly et al., 1993). Hence, novel ideas should be appreciated as creative

input by people high in need for autonomy, and this in turn should result in higher cognitive stimulation than non-novel input.

Secondly, people high in need for structure will probably *not* appreciate novel input as creative, precisely because novel ideas are surprising and add a new perspective. For example, people high in need for closure are less open to new or novel input when brainstorming (as well as in other group tasks), and hence generate fewer (creative) ideas (Chirumbolo et al., 2004; 2005; De Dreu et al., 2008). Moreover, people who have a proximal, concrete processing style, or who have a high motivation to reduce uncertainty, tend to evaluate creative ideas more negatively (Mueller et al., 2012; Mueller et al., 2014). Also, people who are oriented towards safety and avoidance of errors tend to evaluate novel input as being less novel (Zhou et al., 2017). Hence, we expect that novel input disrupts idea generation for those high in need for structure, because the input is less closely related to their own mental images (Dugosh & Paulus, 2005) and existing knowledge, making it harder to assess and perceive the idea as being creative or to be stimulated by it (Dugosh & Paulus, 2005). Moreover, people high in need for structure are likely to have less positively valenced associations for novel ideas (cf., Zhou et al., 2017). We therefore expected that these people would not perceive novel input as a creative contribution (Gocłowska et al., 2014), and that this in turn would result in less cognitive stimulation than non-novel input.

Theoretical Model

Our expectations are summarized in our theoretical model (see Figure 1, p. 62). Novel input was expected to predict creativity perceptions, which in turn predicts cognitive stimulation: that is, productivity, idea generation, task enjoyment, and reduced feelings of being blocked. This indirect effect of novel input on cognitive stimulation was expected to be weakened by need for structure and strengthened by need for autonomy.

To test our propositions, we conducted an experiment where we assessed participants' need strengths and manipulated the novelty of input. In Study 1, we tested our whole model, including the moderating role of both psychological needs and the mediating role of perceived creativity. In two additional studies, we examined whether participants might even prefer to receive no input at all rather than non-novel input (Study 2) or novel input (Study 3) that does not match their needs. We expected that people would show more favorable outcomes when not receiving any input than when receiving input mismatching their needs. Important to note is that Study 2 and 3 included a 'no input' control condition, so that it was not possible to test the mediating effect of perception of creativity of input in these studies. As all three experiments relied on the same method, we describe the combined methods below.

Methods

Samples and Design

Three laboratory studies were conducted to examine the causal relation between input novelty and brainstorming outcomes as moderated by the need for structure and autonomy (Studies 1-3), and mediated by the perceived creativity of input (Study 1). In these studies, participants brainstormed individually during a 10-minute session on computers located in separate cubicles. However, all participants were led to believe they were working together with another participant via interactive online software.

Study 1. Participants were randomly assigned to one of two conditions (non-novel input [n = 39] versus novel input [n = 39]). Seventy-eight undergraduate Psychology students (36% male) voluntarily participated in this study for partial course credits. Their ages ranged between 18 and 24 years (M = 20.18, SD = 1.56).

Study 2. Participants were randomly assigned to one of two conditions (no input [n = 43] versus novel input [n = 43]). Eighty-six undergraduate Psychology students (42% male)

voluntarily participated in this study for partial course credits. Their ages ranged between 19 and 29 years (M = 20.12, SD = 1.80).

Study 3. Participants were randomly assigned to one of two conditions (no input [n = 40] versus non-novel input [n = 41]). Eighty-one students (33% male) of a Dutch university voluntarily participated in this study either for token payment (€5, approximately $6.85 U.S. dollars) or for partial course credits. Their ages ranged between 18 and 29 years (M = 21.94, SD = 2.42). Most of the participants studied Psychology (61%), followed by Economics and Business (16%), Natural sciences (7%), Law (7%), Arts (6%), and Medical sciences (3%).

Procedure

Participants were seated at computers in individual cubicles. They were told that during this study they would "brainstorm together with another student via the Internet, to come up with ideas to create a healthy lifestyle." In fact, however, all participants brainstormed individually. Before starting the brainstorm task, the participants filled out a questionnaire about their psychological need strengths, after which they were informed about the four brainstorming rules, and were instructed to keep these in mind while brainstorming (see Osborn, 1957). The participants brainstormed for 10 minutes, after which they answered questions regarding the work process and their demographics.[1] At the end of the study, the participants were thanked and debriefed.

Manipulation of input. For the experiments, we created an online brainstorming program, so as to enhance the idea of working together with another participant via the Internet. Also, participants who were in one of the input conditions were informed that they were able to exchange ideas with the other participant by pressing a 'share' button, and that the other participant could do the same. Because individuals typically generate about one idea per minute (Paulus et al., 2005), a total of 9 pre-programmed pop-ups appeared, with intervals of 30, 60, or 90 seconds. The time intervals of these pop-ups were fixed but not constant, to

avoid raising any suspicion about their pre-programmed nature. The pop-ups were said to display ideas shared by the other participant, but in fact showed pre-programmed ideas that had been previously rated by two independent experts in earlier unrelated research (Rietzschel et al., 2007) as either non-novel or novel, and as moderate on feasibility for all selected ideas.[2] An example of non-novel input to increase health read "Don't smoke", and for novel input, "Add vitamins to chewing gum." When a pop-up appeared, the idea presented was directly visible to the participant and had to be closed to be able to continue typing in ideas.

Moderators and Mediator

Cronbach's alphas of all variables are displayed in Tables 1, 5, and 7. Unless indicated otherwise, participants responded on a 5-point Likert scale ranging from 1 ('strongly disagree') to 5 ('strongly agree').

Need for structure and need for autonomy were each measured using 4 items of the Psychological Need Strength scale by Van Yperen et al. (2014), which were adapted to fit the context of the current task. A sample item for need for structure is "In a brainstorming situation, I have a need for order and regularity", and for need for autonomy, "In a brainstorming situation, I have a need to have a say in determining my activities and tasks." Participants responded on a 7-point Likert scale ranging from 1 ('not at all') to 7 ('to an extremely large extent').

Perceived creativity (Study 1) was measured using one item: "The ideas I received from the other participant were creative."

Dependent Variables

Productivity was measured as the total number of non-duplicated ideas submitted per participant, i.e., all ideas that did not directly overlap with previously stated ideas and were not identical to the preprogrammed input.

Idea diversity was defined as the number of different categories used, as independently coded by two trained raters who were blind to conditions. A category matrix system was used that crossed twelve specific goals (e.g., "improve bodily fitness") with ten means to reach these goals (e.g., "physical activity"), resulting in 120 different possible categories (See Nijstad et al., 2002). The second rater randomly rated 20% of these ideas. Agreement between the raters was high, with $\kappa = .96$ (95% CI [.93, .99]), $p < .0001$), which we deemed sufficiently high to use the ratings of the first rater.

Task enjoyment was measured using 4 items from Van Yperen (2003), adapted to fit the current task. A sample item is "Did you enjoy doing the brainstorming task?"

Feeling blocked in coming up with new ideas during the brainstorming task was assessed using one item created for the purpose of this study: "I felt blocked in coming up with new ideas".

Results Study 1 – Non-novel versus Novel Input

Preliminary Analysis and Data Treatment

One participant in the novel input condition showed insufficient effort in responding (Huang et al., 2012).[3] As inclusion of these data would likely lower the sample's reliability, this participant was dropped from all analysis. Descriptives, correlations, and Cronbach's alphas of all variables are given in Table 1. The highest correlations were obtained between productivity and idea diversity ($r = .65$, $p < .001$) and between condition and perceived creativity ($r = .61$, $p < .001$), the latter indicating that, as expected, participants on the whole perceived novel input as more creative than non-novel input ($M_{\text{non-novel}} = 2.64$ vs $M_{\text{novel}} = 4.08$, $t(75) = -6.64$, $p < .001$). Also, a positive significant relation between need for structure and need for autonomy was found ($r = .27$, $p = .02$). To control for this relation in subsequent analyses, both need strengths were included simultaneously in the analyses of the moderated mediation model.

Table 1. *Means, Standard Deviations, Correlations, and Cronbach's Alphas Study 1*

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Sex (scored -1 for men, +1 for women)	NA	NA	NA									
2. Age	20.18	1.56	-.19†	NA								
3. Condition (scored -1 for non-novel input, +1 for novel input)	NA	NA	-.01	-.05	NA							
4. Need for Structure	3.48	1.10	.20†	-.08	-.06	(.89)						
5. Need for Autonomy	4.62	.89	-.04	.01	-.12	.27*	(.83)					
6. Perceived creativity	3.35	1.19	.11	-.15	.61**	-.03	-.14	NA				
7. Productivity	10.32	3.14	-.03	.06	.02	-.03	-.06	.08	NA			
8. Idea diversity	6.49	1.85	-.03	.01	-.05	.12	-.09	.16	.65**	NA		
9. Task enjoyment	3.56	.75	.08	-.04	-.13	-.17	-.07	.22†	.05	.13	(.87)	
10. Feeling blocked	2.83	1.12	.06	-.04	.01	.12	.01	.01	-.18	-.07	-.32**	NA

Note. $n = 77$. † $p < .10$; * $p < .05$; ** $p < .01$. When applicable, the corresponding Cronbach's alpha is displayed on the diagonal.

Sex and age were evenly distributed across conditions ($\chi^2_{sex}(1, N = 78) = .00$, $p = 1.00$; $F_{age}(1, 75) = .18$, $p = .67$ ($M_{non\text{-}novel\ info}$= 20.26 vs $M_{novel\ info}$= 20.11), and showed no significant effects on cognitive stimulation effects, $ps_{sex} > .20$ and $ps_{age} > .25$[4].

Hypothesis Testing

We used Hayes' (2013) PROCESS SPSS macro (model 58), with a bootstrapping sample size of 5000, to test the conditional process model that input novelty would predict brainstorming outcomes through perceived creativity, and that this indirect path would be weakened by need for structure, and strengthened by need for autonomy (See Figure 1, p. 62). Following Hayes (2013), rather than conducting separate moderation and mediation analyses for parts of our model, we tested the total model in one analysis for each of the dependent variables.[5]

Performance Component

Productivity. In contrast to our expectations, no moderated mediation effects were obtained for productivity (see Table 2). We therefore investigated whether the direct effect of input novelty on productivity was moderated by need for structure and need for autonomy, without a mediating effect of perceived creativity. This regression analysis yielded a positive interaction of input novelty and need for autonomy ($b = .91$, $t(69) = 2.10$, $p = .04$, $R^2 = .08$, see Figure 2), but no significant interaction with need for structure (see Table 3). Simple slope analysis showed that novel input, as compared to non-novel input, was positively (but not significantly) associated with productivity when participants were high in need for autonomy ($b = .76$, $t(69) = 1.47$, $p = .15$), and negatively (but not significantly) associated with productivity when participants were low in need for autonomy ($b = -.66$, $t(69) = -1.13$, $p = .21$).

Table 2. *Bootstrap Results for Moderated Mediation Study 1*

	Direct effect: Input novelty → Outcome		**Moderated mediation effect (total model)**	
	b-value (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Need for structure				
Productivity	-.15 (.47)	[-1.09; .79]	.22 (.29)	[-.35; .79]
Idea diversity	**.27† (.27)**	**[-.98; .08]**	**.35 (.17)**	**[.06; .71]**
Task enjoyment	**-.31** (.10)**	**[-.52; -.11]**	**.21 (.07)**	**[.09; .38]**
Feeling blocked	.02 (.17)	[-.32; .35]	-.01 (.12)	[.25; .22]
Need for autonomy				
Productivity	-.19 (.47)	[-1.12; .74]	.17 (.28)	[-.41; .70]
Idea diversity	**-.46† (.27)**	**[-.99; .07]**	**.33 (.16)**	**[.05; .71]**
Task enjoyment	**-.32** (.10)**	**[-.52; -.12]**	**.20 (.07)**	**[.08; .37]**
Feeling blocked	.05 (.16)	[-.27; .37]	.03 (.11)	[-.19; .23]

Note. If CI does not include zero, the effect is considered statistically significant and is displayed in bold. $n = 77$. † $p < .10$; * $p < .05$; ** $p <$

Table 2 (continued). *Bootstrap Results for Moderated Mediation Study 1*

	Mediator effects				**Moderator effects**			
	Input novelty → Perceived creativity		**Perceived creativity → Outcome**		**Input novelty x Need strength → Perceived creativity**		**Perceived creativity x Need strength → Outcome**	
	b-value(SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Need for structure								
Productivity	**1.29** (.38)**	**[.52; 2.05]**	-.01 (1.19)	[-2.38; 2.35]	-.17 (.10)	[-.37; .04]	.09 (.33)	[-.56; .75]
Idea diversity	**1.29** (.38)**	**[.52; 2.05]**	.21 (.67)	[-1.12; 1.55]	-.17 (.10)	[-.37; .04]	.08 (.18)	[-.29; .45]
Task enjoyment	**1.29** (.38)**	**[.52; 2.05]**	.15 (.26)	[-.36; .66]	-.17 (.10)	[-.37; .04]	.04 (.07)	[-.10; .18]
Feeling blocked	**1.29** (.38)**	**[.52; 2.05]**	.27 (.42)	[-.57; 1.11]	-.17 (.10)	[-.37; .04]	-.08 (.12)	[-.31; .15]
Need for autonomy								
Productivity	-.30 (.59)	[-1.48; .88]	-1.67 (1.65)	[-4.96; 1.61]	**.22† (.13)**	**[-.03; .47]**	.41 (.33)	[-.25; 1.08]
Idea diversity	-.30 (.59)	[-1.48; .88]	.06 (.94)	[-1.82; 1.93]	**.22† (.13)**	**[-.03; .47]**	.09 (.19)	[-.29; .47]
Task enjoyment	-.30 (.59)	[-1.48; .88]	.03 (.36)	[-.68; .74]	**.22† (.13)**	**[-.03; .47]**	.06 (.07)	[-.09; .20]
Feeling blocked	-.30 (.59)	[-1.48; .88]	**1.39 (.57)**	**[.26; 2.52]**	**.22† (.13)**	**[-.03; .47]**	**-.29* (.11)**	**[-.52; -.07]**

Note. If CI does not include zero, the effect is considered statistically significant and is displayed in bold. $n = 77$. † $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 3. *Results for the Moderated Regression Analysis Study 1*

		Productivity	
Regression model	*b-value*	*(SE)*	*95% CI*
Intercept	7.91	(4.86)	[-1.78; 17.60]
Sex	-.09	(.40)	[-.89; .72]
Age	.12	(.24)	[-.35; .60]
Condition	.05	(.37)	[-.68; .78]
Need for Structure	.01	(.36)	[-.70; .73]
Need for Autonomy	-.25	(.43)	[-1.12; .62]
Cond x Need for structure	-.40	(.36)	[-1.12; .31]
Cond x Need for autonomy	**.91***	**(.43)**	**[.04; 1.76]**
R^2	.27		
Adj. R^2	.07		

Note. Unstandardized regression coefficients are shown. $n = 77$. † $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .00$.

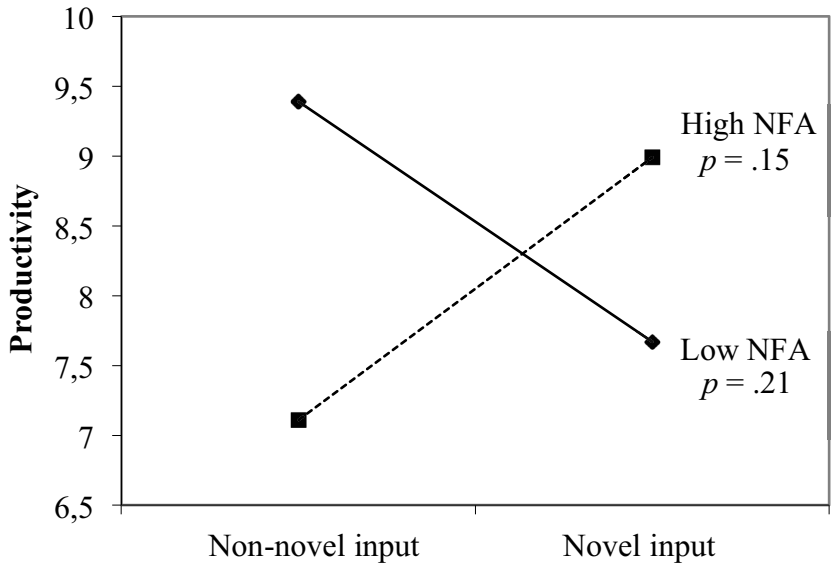

Figure 2. Study 1: Productivity as a function of input novelty and need for autonomy (NFA).

Table 4. *Bootstrap Results for Moderated Mediation at Different Levels of the Moderator Study 1*

		Idea diversity		**Task enjoyment**		**Feeling blocked**	
		b-value (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Need for structure	*Value need strength*						
Low	2.38	.36 (.29)	[-.14; 1.02]	**.22 (.13)**	**[.08; .52]**	.06 (.19)	[-.34; .40]
Moderate	3.48	**.35 (.17)**	**[.06; .71]**	**.21 (.07)**	**[.09; .38]**	-.01 (.12)	[-.25; .22]
High	4.58	**.31 (.15)**	**[.08; .72]**	**.18 (.07)**	**[.08; .36]**	-.06 (.12)	[-.33; .17]
Need for autonomy							
Low	3.73	.20 (.15)	[-.03; .59]	**.12 (.08)**	**[.01; .32]**	.15 (.10)	[-.00; .43]
Moderate	4.62	**.33 (.16)**	**[.05; .71]**	**.20 (.07)**	**[.08; .37]**	.03 (.11)	[-.19; .23]
High	5.50	**.50 (.28)**	**[.00; 1.10]**	**.30 (.12)**	**[.10; .56]**	-.20 (.17)	[-.56; .12]

Note. Low, moderate, and high levels of the need strengths are constituted as the M-level of the need strength, ± 1 SD. If CI does not include zero, the moderated mediation effect is considered statistically significant and is displayed in bold. $n = 77$.

Idea diversity. As expected, the conditional indirect effect of input novelty on idea diversity through perceived creativity was significant for both need strengths (need for structure: b = .35, 95% CI [.06, .71], need for autonomy: b = .33, 95% CI [.05, .71]; see also Table 2).[6] On the whole, people who received novel input rather than non-novel input were more flexible in their generation of ideas, as the conditional effects at low, moderate, and high levels were all positive (see Table 4). However, in line with our hypotheses, this effect was weaker for participants with higher levels of need for structure and for participants with lower levels of need for autonomy. As can be seen in Figure 3, the positive effect of input novelty on idea diversity through perceived creativity was weaker for people high in need for structure than for those low in need for structure. Conversely, the positive effect of novelty on idea diversity through perceived creativity was stronger for people high in need for autonomy than for people low in need for autonomy (see Figure 4).

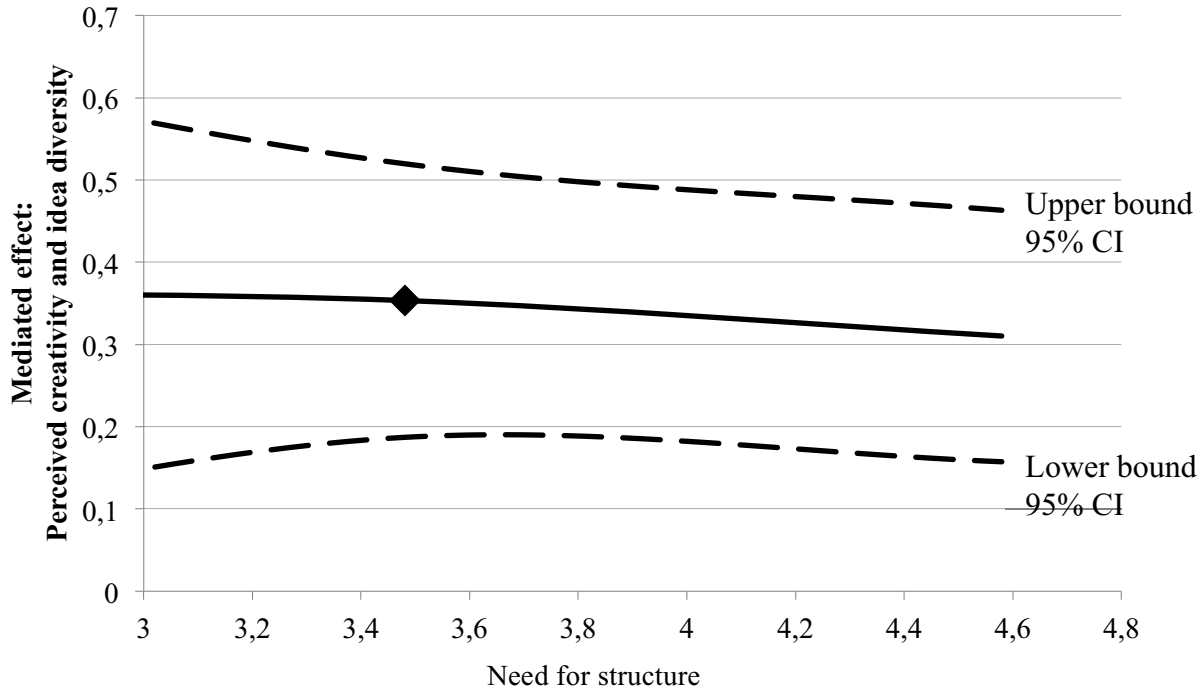

Figure 3. Study 1: A plot of the conditional indirect effect of input novelty on idea diversity through perceived creativity, conditioned on the moderator (need for structure), with 95% confidence bands. The square indicates the mean level of the need strength.

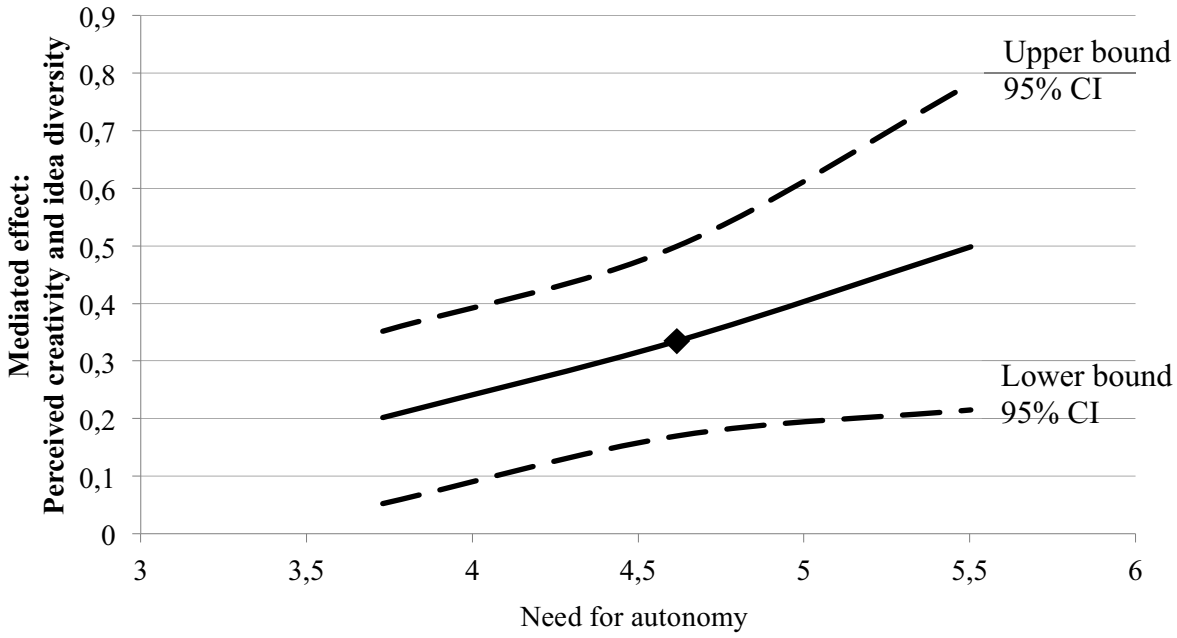

Figure 4. Study 1: A plot of the conditional indirect effect of input novelty on idea diversity through perceived creativity, conditioned on the moderator (need for autonomy), with 95% confidence bands. The square indicates the mean level of the need strength.

Psychological Component

Task enjoyment. As expected, the conditional indirect effect of input novelty on task enjoyment through perceived creativity was significantly moderated by both needs (need for structure: b = .21, 95% CI [.09, .38], need for autonomy: b = .20, 95% CI [.08, .37]; see also Table 2).[6] On the whole, people who received novel input rather than non-novel input enjoyed the task more, as the conditional effects at low, moderate, and high levels were all positive (see Table 4). However, in line with our hypotheses, this effect was weaker for participants with higher levels of need for structure, and for participants with lower levels of need for autonomy. As can be seen in Figure 5, the positive effect of input novelty on task enjoyment through perceived creativity was weaker for people high in need for structure than for those low in need for structure. Conversely, the positive effect of novelty on task enjoyment through perceived creativity was stronger for people high in need for autonomy than for people low in need for autonomy (see Figure 6).

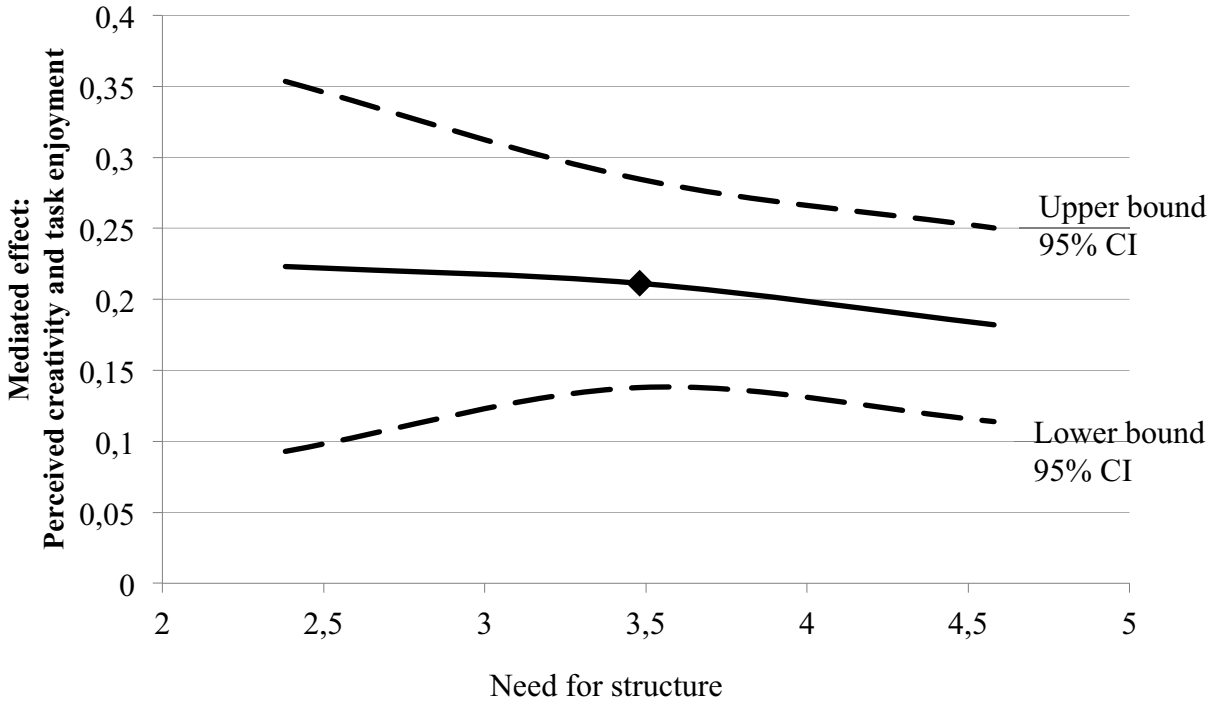

Figure 5. Study 1: A plot of the conditional indirect effect of input novelty on task enjoyment through perceived creativity, conditioned on the moderator (need for structure), with 95% confidence bands. The square indicates the mean level of the need strength.

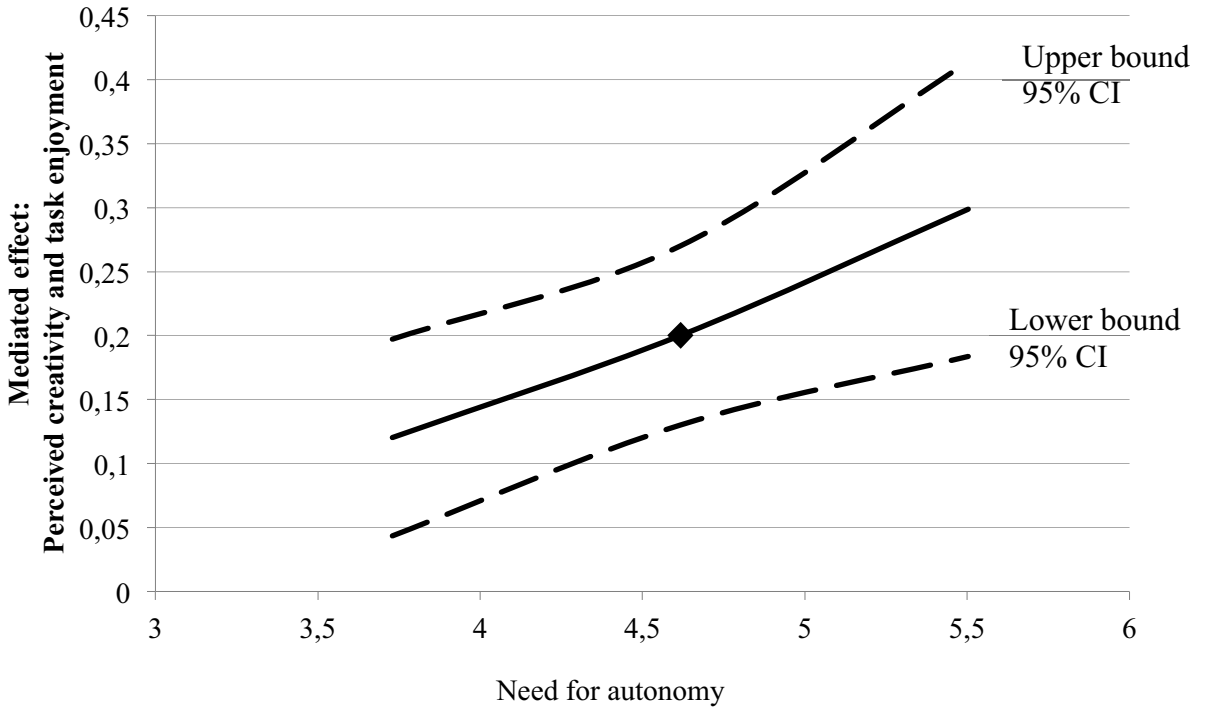

Figure 6. Study 1: A plot of the conditional indirect effect of input novelty on task enjoyment through perceived creativity, conditioned on the moderator (need for autonomy), with 95% confidence bands. The square indicates the mean level of the need strength.

Feeling blocked. In contrast to what was expected, no conditional indirect effect of input novelty on feeling blocked was obtained (see Table 2). However, when we focused on the need for autonomy, we found two separate moderation effects in the model that were in line with our expectations. These indicated a positive interaction effect for input novelty and need for autonomy on perceived creativity (i.e., for the first part of the model), and a negative interaction effect for perceived creativity and need for autonomy on feeling blocked (i.e., for the second part of the model) (see Table 2). As can be seen in Figure 7, the positive effect of input novelty on feeling blocked through perceived creativity was weaker for people high in need for autonomy than for people low in need for autonomy. No effects were obtained for need for structure.

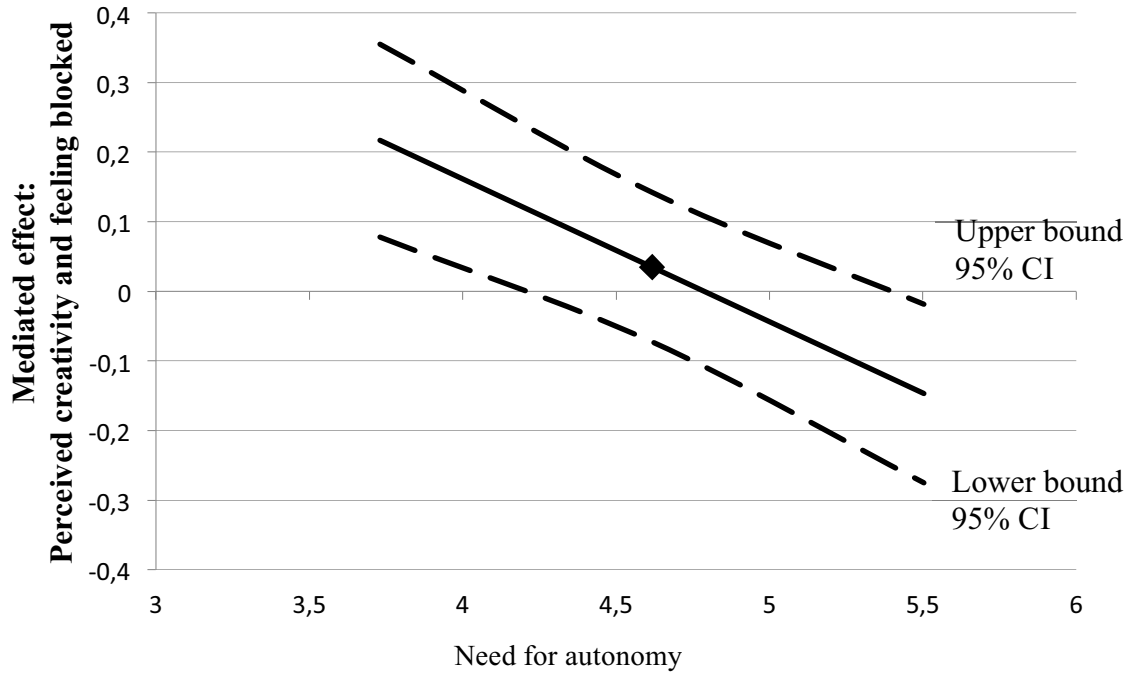

Figure 7. Study 1: A plot of the conditional indirect effect of input novelty on feeling blocked through perceived creativity, conditioned on the moderator (need for autonomy), with 95% confidence bands. The square indicates the mean level of the need strength.

Discussion Study 1

The results of Study 1 indicate that novel input indeed has an indirect effect on cognitive stimulation through perceived creativity. As expected, this path was moderated by psychological needs, such that those with a high (vs. low) need for structure and those with a low (vs. high) need for autonomy benefited less from exposure to novel ideas. The type of input that results in cognitive stimulation apparently is not the same for everybody, and ideas intended to be helpful are in fact not always cognitively stimulating. In such instances where a misfit is created, it may be better not to receive any ideas at all. We conducted two additional experiments to test this question. In these studies, participants either received input or not, with the type of input (novel or non-novel) differing between the two studies. For participants with a high need for structure, we expected more cognitive stimulation when receiving no input than when receiving highly novel input (Study 2). For participants with a high need for autonomy, we expected more cognitive stimulation when receiving no input than when receiving non-novel input (Study 3).

Results Study 2 - Novel Input and Need for Structure

Preliminary Analyses and Data Treatment

Descriptives, correlations, and Cronbach's alphas for all variables are given in Table 5. Similarly to Study 1, the highest correlation was obtained for productivity and idea diversity ($r = .84$, $p < .001$). The relation between need for structure and need for autonomy ($r = .26$, $p = .02$) was taken into account by creating regression models that included both moderators. Sex and age were more or less evenly distributed across conditions, $\chi^2_{sex}(1, N = 86) = .76$, $p = .38$, and $F_{age}(1, 84) = .71$, $p = .40$ ($M_{novel\ info} = 20.28$ vs $M_{no\ info} = 19.95$).

Hypothesis Testing

For all dependent variables, hypotheses were tested by running a regression analysis with input, need for structure, need for autonomy, and the two interaction terms of input with the needs. To represent the interaction between input (dummy coded -1 = no input, 1 = input) and psychological needs, the need variable under investigation was first standardized and then multiplied by condition (Aiken & West, 1991). Last, sex (with two levels, '-1' for men and '1' for women) and age were included as covariates in all analyses, and indicated no significant effects on brainstorming outcomes: ps > .15 for sex and ps > .10 for age, with some exceptions (see Table 6).[4]

Table 5. *Means, Standard Deviations, Correlations and Cronbach's Alphas Study 2*

Variable	Mean	NA	SD	1	2	3	4	5	6	7	8	9
1. Sex (scored -1 for men, +1 for women)	NA	20.12	NA	NA								
2. Age	20.12	NA	1.79	-.13	NA							
3. Condition (scored -1 for no input, +1 for novel input)	NA	3.56	NA	.09	-.09	NA						
4. Need for Structure	3.56	4.51	1.00	.25*	.12	.03	(.89)					
5. Need for Autonomy	4.51	9.64	.90	.12	-.01	.10	.26*	(.83)				
6. Productivity	9.64	5.93	4.25	-.12	-.19†	-.11	-.03	-.03	NA			
7. Idea diversity	5.93	3.44	2.23	-.25*	-.13	-.09	-.08	.01	.84**	NA		
8. Task enjoyment	3.44	2.92	.77	.12	.05	.16	.11	-.18	.17	.18	(.88)	
9. Feeling blocked	2.92	NA	1.20	.10	-.09	.22*	.04	.15	-.18†	-.18†	-.14	NA

Note. $n = 86$. † $p < .10$; * $p < .05$; ** $p < .01$. When applicable, the corresponding Cronbach's alpha is displayed on the diagonal.

Table 6. *Results for the Moderated Regression Analyses Study 2*

	Dependent variables							
	Productivity		**Idea diversity**		**Task enjoyment**		**Feeling blocked**	
Regression model	*b-value*	*95% CI*	*b-value*	*95% CI*	*b-value*	*95% CI*	*b-value*	*95% CI*
Intercept	**20.01*** **	**[9.45;30.75]**	**10.29*** **	**[4.73; 15.86]**	**2.61** **	**[.74;4.48]**	**4.15** **	**[1.20;7.11]**
Sex	-.69	[-.166;.28]	**-.62***	**[-1.12;-.11]**	.11	[-.06;.28]	.05	[-.22;.32]
Age	**-.51†**	**[-1.04;.02]**	-.21	[-.49;.06]	.04	[-.05;.13]	-.06	[-.21;.08]
Condition	-.47	[-1.38;.45]	-.20	[-.67;.29]	.13	[-.03;.29]	**.23†**	**[-.02;.49]**
Need for Structure	.03	[-.96;1.01]	-.03	[-.55;.48]	.12	[-.05;.30]	-.02	[-.29;.26]
Need for Autonomy	-.06	[-1.14;1.03]	.11	[-.46;.68]	**-.25***	**[-.44;-.06]**	.23	[-.07;.53]
Cond x Need Struc	.14	[-.83;1.10]	.00	[-.51;.51]	**-.20***	**[-.37;-.03]**	**.26†**	**[-.01;.53]**
Cond x Need Aut	-.81	[-1.89;.28]	-.20	[-.76;.37]	.07	[-.12;.26]	.04	[-.27;.34]
R^2	.10		.11		.16		.13	
Adj. R^2	.01		.02		.08		.05	

Note. [a]Unstandardized regression coefficients are shown. $n = 86$. $^{\dagger}p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Performance Component

Productivity. Contrary to expectations, no main or interaction effects were obtained.

Idea diversity. Contrary to expectations, only a negative main effect for sex was obtained (b = -.62, t = -2.42, p = .02).

Psychological Component

Task enjoyment. In line with hypotheses, the regression analysis yielded a negative interaction effect of input and need for structure (b = -.20, $t(78)$ = -2.31, p = .02, see Figure 8). However, contrary to expectations, simple slopes analysis showed that novel input, as compared to no input, resulted in higher levels of task enjoyment for participants low in need for structure (b = .26, t = 2.16, p = .03), but did not significantly affect participants high in need for structure (b = -.03, t = -.21, p = .83). The regression analysis also revealed a negative main effect for need for autonomy, indicating that those high in need for autonomy enjoyed the task less (b = -.25, $t(78)$ = -2.59, p = .01).

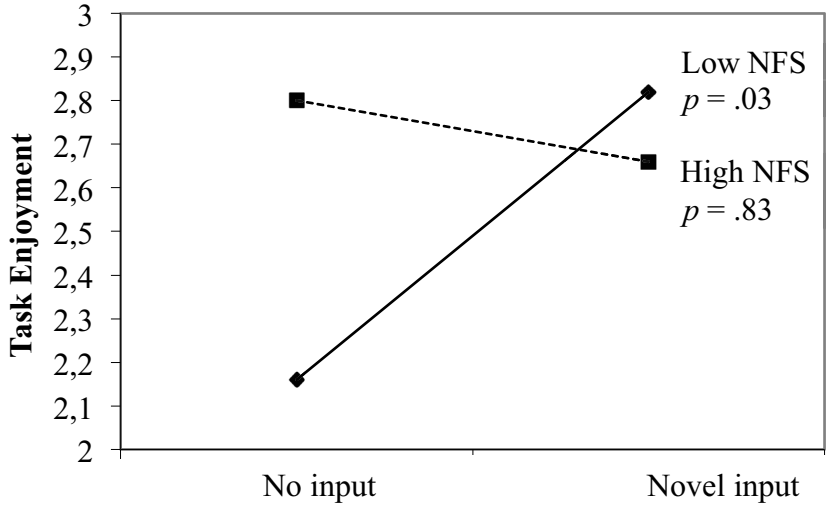

Figure 8. Study 2: Task enjoyment as a function of no input versus novel input and need for structure (NFS).

Feeling blocked. As expected, the regression analysis yielded a positive interaction effect of input and need for structure (b = .26, $t(78)$ = 1.94, p = .057, see Figure 9). Simple slopes analysis showed that novel input, as compared to no input, was positively (and significantly) associated with feeling blocked when participants were high in need for structure (b = .48, t = 2.67, p = .01), but not when participants were low in need for structure (b = .02, t = 1.00, p = .92).

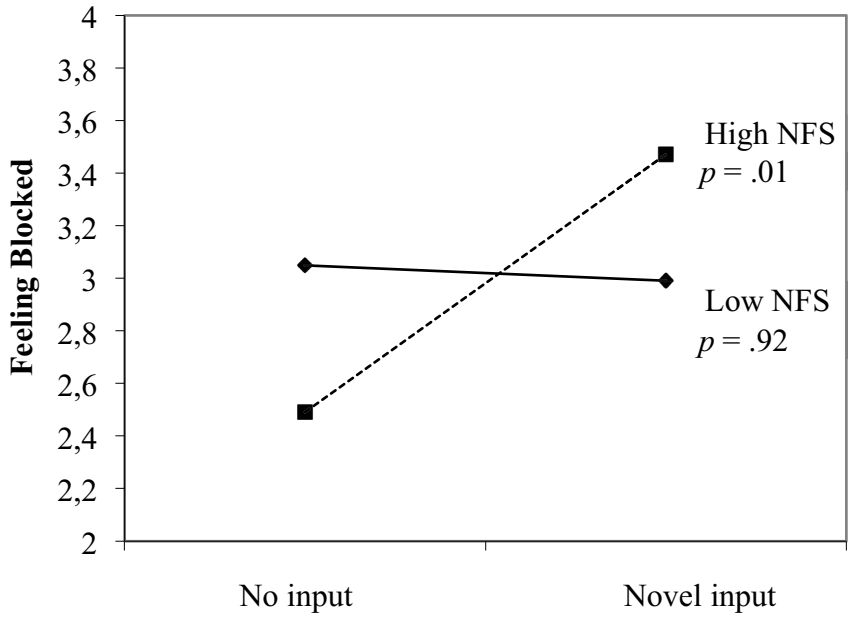

Figure 9. Study 2: Feeling blocked as a function of no input versus novel input and need for structure (NFS).

Results Study 3 – Non-novel Input and Need for Autonomy

Preliminary Analyses and Data Treatment

Descriptives and Cronbach's alphas of all variables are given in Table 7. The highest correlation was obtained between productivity and idea diversity ($r = .85$, $p < .001$). The relation between need for structure and need for autonomy ($r = .33$, $p < .001$) was taken into account by creating regression models that included both moderators. Sex and age were more or less evenly distributed across conditions, $\chi^2_{sex}(1, N = 81) = 1.21$, $p = .27$, and $F_{age}(1, 79) = .10$, $p = .75$ ($M_{no\ input} = 21.85$ vs. $M_{non\text{-}novel\ input} = 22.02$), and indicated no significant effects on brainstorming outcomes, ps > .15 for sex and ps > .10 for age, with some exceptions (see Table 8).[4]

Hypothesis Testing

For all dependent variables, hypotheses were tested by running regression analyses similar to those in Study 2. All regressions are summarized in Table 8.

Table 7. *Means, Standard Deviations, Correlations and Cronbach's Alphas Study 3*

Variable	Mean	SD	1	2	3	4	5	6	7	8	9
1. Sex (scored -1 for men, +1 for women)	NA	NA	NA								
2. Age	21.94	2.42	-.32**	NA							
3. Condition (scored -1 for no input, +1 for non-novel input)	NA	NA	.12	-.04	NA						
4. Need for Structure	3.38	1.15	.35**	-.29**	.04	(.87)					
5. Need for Autonomy	4.51	1.06	.12	.07	.04	.33**	(.88)				
6. Productivity	9.86	4.94	.08	-.05	.01	-.04	-.04	NA			
7. Idea diversity	6.41	2.70	.28*	-.08	.25*	.06	.05	.85**	NA		
8. Task enjoyment	3.85	.75	.19	.19	.11	.15	.31**	-.04	.02	(.88)	
9. Feeling blocked	2.53	1.16	.21	-.16	.08	.24*	-.08	-.05	.13	-.24*	NA

Note. $n = 81$. $^{\dagger}p < .10$; *$p < .05$; **$p < .01$. When applicable, the corresponding Cronbach's alphas are displayed on the diagonal.

Table 8. *Results for the Moderated Regression Analyses Study 3*

	Dependent variables							
	Productivity		**Idea diversity**		**Task enjoyment**		**Feeling blocked**	
Regression model	*b-value*	*95% CI*	*b-value*	*95% CI*	*b-value*	*95% CI*	*b-value*	*95% CI*
Intercept	**11.63***	**[.05;23.20]**	**6.21***	**[.27; 12.15]**	**1.93***	**[.36; 3.51]**	**2.89***	**[.36;5.41]**
Sex	.58	[-.78;1.95]	**.83***	**[.13; 1.53]**	.13	[-.05; .32]	.16	[-.14;.46]
Age	-.09	[-.61;.43]	-.00	[-.27; .26]	**.09***	**[.02; .16]**	-.02	[-.13;.09]
Condition	.00	[-1.14;1.15]	**.57†**	**[-.02; 1.15]**	.06	[-.10; .22]	.07	[-.18;.32]
Need for Structure	-.37	[-1.55;.82]	-.16	[-.77; .44]	.08	[-.09; .24]	.21	[-.05;.46]
Need for Autonomy	-.12	[-1.30;1.06]	.04	[-.56; .65]	**.19***	**[.03; .35]**	-.18	[-.44;.08]
Cond x Need Struc.	.31	[-.79;1.42]	.21	[-.36; .77]	-.11	[-.26; .04]	-.06	[-.30;.18]
Cond x Need Aut.	-.34	[-1.50;.82]	-.05	[-.65; .54]	-.02	[-.18; .13]	**.27***	**[.01;.52]**
R^2	.02		.14		.21		.16	
Adj. R^2	-.07		.05		.14		.08	

Note. [a]Unstandardized regression coefficients are shown. $n = 81$. † $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Performance Component

Productivity. Contrary to expectations, no main or interaction effects were obtained.

Idea diversity. Contrary to expectations, only a positive main effect for sex was obtained (b = .83, t(75) = 2.37, p = .02).

Psychological Component

Task enjoyment. Contrary to expectations, only a positive main effect for age and need for autonomy was obtained (b = .09, t(75) = 2.41, p = .02 and b = .19, t(75) = 2.37, p = .02, respectively).

Feeling blocked. As expected, the regression analysis yielded a positive interaction of input and need for autonomy (b = .27, t(75) = 2.10, p = .04, see Figure 10). Simple slopes analysis showed that non-novel input (relative to no input) resulted in feeling blocked when participants were high in need for autonomy (b = .37, t = 2.06, p = .04), but not when participants were low in need for autonomy (b = -.13, t = -1.01, p = .32).

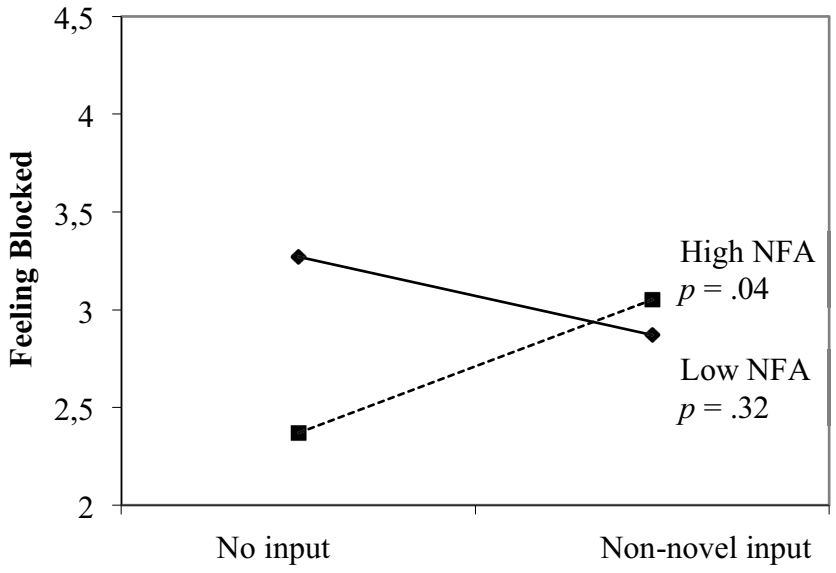

Figure 10. Study 3: Feeling blocked as a function of no input versus non-novel input and need for autonomy (NFA).

General Discussion

In the present research, we aimed to address the role of novelty and individual differences in cognitive stimulation during brainstorming. We expected and found that the indirect effect of input novelty on cognitive stimulation through perceived creativity is *weakened* by the need for structure and *strengthened* by the need for autonomy. Specifically, people high in need for structure did not perceive highly novel ideas as creative, and therefore showed lower idea diversity and less task enjoyment. In addition, receiving novel input (compared with not receiving input) resulted in a tendency to enjoy the task somewhat (although not significantly) less, and in feeling more blocked in generating ideas. These results are in line with the notion that participants high in need for structure do not appreciate novel input that adds complexity and ambiguity, but prefer non-novel input that provides them with clarity, predictability, and certainty.

We found more or less the opposite pattern for participants high in need for autonomy: They perceived novel input as more creative, which in turn predicted higher idea diversity and task enjoyment, as well as lower feelings of being blocked. In addition, receiving novel input resulted in higher productivity for them relative to non-novel input, regardless of their perception of the input as being creative. Also, people high in need for autonomy felt more blocked in their ideation process when they received non-novel input than when they did not receive input at all. These results are in line with the notion that participants high in need for autonomy do not appreciate non-novel input that does not have an added information value over and above the obvious; however, novel input is welcomed as a useful and creative contribution that will help them brainstorming. In contrast to our expectation, no performance-related outcomes were obtained in Studies 2 and 3; we provide a possible explanation below (see 'Limitations and future directions').

Implications

It seems that people can benefit from the ideas of others (Brown et al., 1998; Dugosh et al., 2000; Stroebe, Nijstad, & Rietzschel, 2010), but only if the input received fits their psychological needs and is positively perceived as a creative contribution. In practice, organizations and teams could benefit from our findings by taking both components into account. Firstly, being aware of the individual needs of team members rather than using a 'one size fits all' approach would be important when aiming to increase productivity and cognitive stimulation. Managers or teams could, for example, discuss the needs and preferences with the employees, and could use the short need strength scale (Van Yperen et al., 2014) as a basis for this conversation. Electronic brainstorming could be used, as a tool to adapt the brainstorm setting to one's personal needs.

Secondly, the positive perception of another's idea as being creative depends on its stimulating potential (Zhou et al., 2017). This perception differs per individual, but perceiving the input as creative seems crucial for its potential to further stimulate the creative process. It may therefore be fruitful to train people to reflect on all types of input as having a creative potential. People high in need for structure could, for example, be taught how to deal with and use original or unusual input (e.g., as a useful tool to consider a problem from a new angle), whereas people high in need for autonomy could be made aware of the potential benefits of receiving less original input (e.g., as a starting point to generate more original ideas themselves). Training teams to value information diversity might be a useful starting point in this regard, in order to stimulate the active consideration of the viewpoints and ideas of others. Previous research has indicated that such positive diversity beliefs increase the performance of informationally diverse groups, as it helps people to elaborate more on the information shared (Homan, van Knippenberg, Van Kleef, & De Dreu, 2007). This enhanced elaboration of information may increase one's positive perception of the input as being

creative, and thereby increase the number of associated ideas people generate based on the input. Future research is needed to investigate if these expectations indeed hold.

Limitations and Future Directions

While the findings of the current studies may already be useful for group brainstorming, a possible direction for future creativity research would be to further investigate the effect of perceived creativity and of individual needs. Firstly, more research could investigate the mediating role of perceived creativity in cognitive stimulation, as its role could only be investigated in Study 1. The perception of input as being creative seems to relate to its stimulating potential (Zhou et al., 2017), which makes it interesting to investigate the underlying process of how specific ideas from others stimulate the generation of additional ideas. Cognitive stimulation is normally assessed at a global, interpersonal level (e.g., differences in productivity), but it should be possible to also study it on the level of ideas or strings of ideas within participants. Creating such a measure could provide more insight as to which aspects in presented ideas have stimulating effects, and how people continue brainstorming from this input. As previous research indicates that ideas are appreciated as a creative contribution when these activate new associations in one's mind (Zhou et al., 2017), one could expect that this type of input activates overlapping cognitive responses or associations. This could result in clustering or persistence if people stay within the same category as the stimulus item, or alternatively, could result in in flexibility if people combine their currently activated mental category with the category of the input to generate further ideas[7].

Secondly, more research is needed on the role that individual needs play in cognitive stimulation. Perhaps whether brainstorming input is helpful also depends on the fit of these ideas with one's currently activated mental schemas, especially when people have a high need for structure. For them, diverse input that activates new mental categories may work

disruptively, as this input requires additional information processing and does not fit with their current structure. This line of reasoning fits previous work showing that schema-inconsistent information (Gocłowska et al., 2014) and socially distant information that reinforces new modes of thinking (Baer, 2010) can increase or decrease creative performance, depending on one's needs. Related to this, cognitive diversity in groups seems to work better for some people than for others, especially for those who score high on agreeableness, extraversion, or openness to experience (Nakui, Paulus, Van der Zee, 2011). Similarly, people high in need for autonomy may perceive cognitive diversity as a welcome addition for group brainstorming as it increases the chance of receiving more diverse ideas that could result in new or novel insights. In contrast, those high in need for structure may experience cognitive diversity in the group as unwelcome, as diverse insights and ideas from others further increase complexity and ambiguity in the task.

Thirdly, it would be interesting to examine the process behind the (mis)fit of brainstorming input and psychological needs. In contrast to our expectations, Studies 2 and 3 showed significant effects of input-needs fit only on the psychological component of cognitive stimulation, and not on the performance component. We can only speculate as to why this is the case. It is possible that participants' emotional responses to the task played a role here. For example, a 'misfit' situation may have caused participants to feel angry or frustrated. Activating emotions, whether positive (such as enthusiasm) or negative (such as anger and fear), can stimulate creativity (Nijstad, De Dreu, Rietzschel, & Baas, 2010; Yang & Hung, 2015). Hence, the expected drop in performance in the 'misfit' conditions in Studies 2 and 3 may have been counteracted by the positive effect of these activating emotions. Other work suggests also that experiencing anger when receiving mismatching external input may be expected for those high in need for autonomy. The functional goal resulting from anger is to regain freedom in one's actions and to remove external control (Yang & Hung, 2015), an

end state that is typically desired by those high in need for autonomy. For Study 1, in which we compared a fit versus misfit situation, we would speculate that both conditions activated emotions, the first positive and the latter negative ones, hence cancelling each other out. Further research could include measures of emotions to test this reasoning, and to unravel the effects of mismatching input on participants' emotions. Related to this, it would be interesting to include a measure of memory for the presented ideas, to get an indication as to whether individual differences also affect the extent to which participants pay attention to the ideas presented to them. For example, it may be that those high in need for autonomy pay less attention to the presented ideas, as ideas of others mismatch their preference to work on their own. In turn, this could result in less associational impact from the input[8].

Finally, in the present studies we focused on individual differences in need for structure and need for autonomy. Although these needs are important predictors and moderators in the context of creative performance, work motivation, and group interactions (Chirumbolo et al., 2004; Deci & Ryan, 2000; Van Yperen et al., 2016), it would be interesting to also address the role of other individual differences, such as mood, processing mode, openness to experience, extraversion-introversion, and approach and avoidance temperament (Baas, Roskes, Sligte, Nijstad, & De Dreu, 2013; Baer, 2010; Jung, Lee, & Karsten, 2012; Nijstad et al., 2010). Mapping the ways in which various individual differences moderate cognitive stimulation effects may also help us understand the underlying mechanisms and identify further boundary conditions for stimulation to occur.

Conclusion

Creative performance is highly valued and necessary to achieve innovative behavior and organizational effectiveness (Amabile, 1983; Paulus & Nijstad, 2003). Given that group work is ubiquitous in modern organizations, and that group brainstorming remains highly popular despite the risks of productivity loss, it is important to understand more about the factors that contribute to (or inhibit) the psychological and performance component of cognitive stimulation. The current findings add to our understanding by showing that the level of cognitive stimulation depends on input novelty, perceptions of creativity, and people's psychological needs. There is a need for more research on creativity, focused on the role of psychological needs, in order to better understand the mechanisms through which creative performance unfolds, and to be able to create the ideal circumstances for people to experience cognitive stimulation when brainstorming.

Footnotes

[1]Exploratively, additional variables were included concerning individual needs, task perception, and performance.

[2]For the novel condition, ideas were selected that were rated ≥4 (on a 5-point scale) on novelty, for the non-novel condition, ideas were selected that were rated ≤2 on novelty, $t(16) = -13.91$, $p < .0001$ ($M_{non\text{-}novel\ input} = 1.56$ vs $M_{novel\ input} = 4.00$). Feasibility was held constant at a moderate level in both conditions, with an average of 3.25 on a 5-point scale, $t(16) = -1.47$, $p = .16$ ($M_{non\text{-}novel\ input} = 3.00$ vs $M_{novel\ input} = 3.56$).

[3]This was manifested by the response of 'strongly agree' to all items, including original and reversed items. Additionally, the participant indicated not to have responded carefully to the questions and that we should not use the data.

[4]Analyzing the data without including covariates led to a similar pattern of results.

[5] The PROCESS analysis gives insight in the complete moderated mediation model (Hayes, 2013). For the curious reader, we analyzed the interaction between novelty and need for structure (need for autonomy) predicting perceived creativity (thus, only analyzing the first part of the model). This resulted in significant interactions that are in line with what is expected: a negative interaction effect for need for structure ($b = -.22$, $t(69) = -2.06$, $p = .04$), and a positive interaction effect for need for autonomy ($b = .27$, $t(69) = 2.17$, $p = .03$).

[6]Investigating the specific paths revealed that the direct effect of input novelty on cognitive stimulation was non-significant for both models and that the single moderation effects were not uniquely significant (see Table 2). Only the complete moderated mediation models could explain our findings.

[7,8]We thank an anonymous reviewer for pointing this out.

4

Paving the Pathway to Creativity

The role of Input Diversity and Approach-Avoidance Motivation

Group brainstorming is popular in organizations, but does not always create the cognitive stimulation necessary for creative idea generation to occur. By extending creativity models, we expected that input diversity and individual differences determine the effectiveness of two cognitive pathways to generate ideas (fluency). That is, input likely stimulates the use of a cognitive pathway that aligns with its diversity level and, depending on approach-avoidance motivation, increases fluency. As expected, in two experiments we found that diverse input stimulated the use of the flexibility pathway, while homogeneous input stimulated the use of the persistence pathway, both in turn increasing fluency. This was the case for approach- and avoidance-motivated people, regardless of whether the stimulated pathway supplemented or complemented the individual's usual cognitive pathway. When a complementary pathway was activated, this sometimes resulted in the effective use of both cognitive pathways; other times, only the stimulated pathway resulted in increased fluency.[5]

[5] This Chapter is based on De Jonge, K. M. M., Rietzschel, E. F., & Van Yperen, N. W. (2019). *Paving the Pathway to Creativity: The role of Input Diversity and Approach-Avoidance Motivation.* Manuscript submitted for publication.

CHAPTER 4

Paving the Pathway to Creativity:

The role of Input Diversity and Approach-Avoidance Motivation

Creative performance - generating new ideas that are both novel and useful - is highly valued and necessary to achieve innovative behavior and organizational effectiveness (Amabile, 1983; Paulus & Nijstad, 2003). Group brainstorming is a popular technique used to reach creative idea generation. While input from others creates the risk of interruptions and productivity losses, it also creates the (theoretical) potential for cognitive stimulation: enhancing idea generation by receiving additional ideas to work with (Dugosh, Paulus, Roland, & Yang, 2000; Nijstad & Stroebe, 2006). It is, therefore, important to understand more about the factors that contribute to (or inhibit) the cognitive stimulation necessary for creative idea generation. The present research adds to the literature by investigating what type of input, via which cognitive pathway, results in creative idea generation for whom.

Previous research indicates that input can result in cognitive stimulation whether it covers a wide or small range of perspectives (i.e., is high or low in diversity) (Nijstad, Stroebe, & Lodewijkx, 2002). Yet, the extent to which input does so may depend on individual differences (see also, De Jonge, Rietzschel, & Van Yperen, 2018) that are associated with a preference for a particular cognitive pathway towards creativity. The Dual Pathway to Creativity Model (DPCM) (De Dreu, Baas, & Nijstad, 2008; Nijstad, De Dreu, Rietzschel, & Baas, 2010) posits that stable individual differences such as approach-avoidance motivation determine the cognitive pathways people tend to use when generating ideas. Some tend to use a flexible cognitive pathway that is characterized by generating ideas from diverse semantic categories; others use a persistent cognitive pathway by generating deeper within few semantic categories. We argue and demonstrate in two experimental studies that both the level of input diversity and people's approach-avoidance motivation

determine which cognitive pathway results in creative idea generation (that is, ideational fluency).

Cognitive Stimulation in Brainstorming

The Dual Pathway to Creativity Model (DPCM) states that flexibility and persistence are two different cognitive pathways that people can use when combining knowledge, and that individuals differ in their tendency to use one of these pathways (De Dreu et al., 2008; Nijstad et al., 2010). When people use the *flexibility pathway*, they generate ideas of high diversity. That is, they access their long-term memory using diverse search cues to probe multiple semantic categories (Nijstad & Stroebe, 2006). This allows them to switch between different approaches to and perspectives on the problem or task, and to create new connections between remote (distant) ideas rather than remain focused on semantically close ideas. The *persistence pathway*, in contrast, entails searching deeper within semantic categories or using semantically related search cues to probe long-term memory, rather than using a wide variety of semantically different search cues. This can result in the generation of longer trains of thought within semantic categories (i.e., higher within-category fluency). Importantly, both pathways can lead to high levels of creative fluency, but the underlying mechanisms and strategies are different, and use of these pathways is predicted by different traits and states. In addition to the above, receiving ideas from others may activate ideas that would not have been activated without such an external cue. Consequently, input from group members can work as a search cue as well, which is added to the individual's cognitive search for ideas (Nijstad et al., 2002). Being exposed to external search cues takes less cognitive effort compared with generating search cues oneself, and can thus form a beneficial addition when brainstorming. In line with this, Nijstad and colleagues (2002) observed that both diverse and homogeneous input could increase idea generation, but resulted in different types of idea generation. In

terms of the DPCM, diverse input tends to activate the use of the flexibility pathway, whereas homogeneous input activates the persistence pathway.

Approach-Avoidance Motivation and Stimulating Input

While both diverse and homogenous input can lead to cognitive stimulation (Nijstad et al., 2002), the extent to which they do so may depend on individual differences in approach-avoidance motivation that are associated with a preference for a particular cognitive pathway towards creativity. We focused on the effects of these distinct motivations because they form a dynamic duo, often relating to opposing outcomes within the same context (Elliot, 2008). Also, these motivations have previously been linked to the DPCM as important individual differences that affect the cognitive pathway people prefer (De Dreu et al., 2008; Nijstad et al., 2010).

Approach-motivated people are motivated to achieve gains and rewarding stimuli (Carver, Sutton, & Scheier, 2000; Elliot, 2008; Lewin, 1935). They tend to show explorative and risk-tolerant behavior and an abstract thinking style, focusing on the broad picture rather than on specific details (Elliot, 2008). Also, they show a decreased latent inhibition, which increases the availability of diverse perspectives to work with (Peterson, Smith, & Carson, 2002). They are likely to use the *flexibility pathway* during idea generation, although they may also be relatively easily distracted by irrelevant thoughts (De Dreu et al., 2008; Icekson et al., 2014; Nijstad et al., 2010; Roskes, De Dreu, & Nijstad, 2012)**.**

Avoidance-motivated people are motivated to avoid losses and aversive stimuli (Carver et al., 2000; Elliot, 2008; Lewin, 1935). They tend to show risk-averse and alert behavior and hold a narrow attentional scope, focusing on specific details (Elliot, 2008). This reduces their ability to show cognitive flexibility and to shift attention (Derryberry & Reed, 1998), and results in a tendency to investigate their surroundings only from a few categories and perspectives (De Dreu et al., 2008). This makes it difficult for them to be creative, and

stimulates the use of the *persistence pathway* for idea generation (De Dreu et al., 2008; Nijstad et al., 2010; Roskes et al., 2012)

Cognitive Stimulation and Type of Fit

Both input diversity and individual differences in approach-avoidance motivation thus tend to direct individuals into either a flexible or a persistent cognitive pathway. Taking both aspects into account, we hypothesized that two opposing types of fit may be expected to result in cognitive stimulation. Specifically, we investigated whether *supplementary* or *complementary* input is especially beneficial for cognitive stimulation to occur: i.e., whether it is optimal if the diversity level of the input is in line with versus differs from the individual's preferred cognitive pathway. Previous research on Person-Environment (P-E) fit in fact indicates that both types of fit can be beneficial (Cable & Edwards, 2004). Supplementary fit results when the individual and the environment possess matching characteristics; complementary fit results when the needs of the individual are offset by the characteristics of the environment. Cable and Edwards (2004) found that taking both types of fit into account provides the optimal prediction of work outcomes. That is, both independently, and relatively equally, affect work outcomes. Input may thus be especially cognitively stimulating when its diversity level forms a *supplementary fit* with the individual's preferred pathway (see Figure 1a and 1b for our theoretical model, p. 104). Reasoning from the DPCM (De Dreu et al., 2008; Nijstad et al., 2010), people may be especially cognitively stimulated when the input resembles and reinforces their usual pathway in brainstorming. This type of input is likely easiest to use as an additional search cue, and tends to create a feeling of validation of one's personal perspectives (Cable & Edwards, 2004). If this fit perspective holds, highly diverse input would be easiest to work with and most stimulating for approach-motivated people, as they have a strong preference for the flexibility pathway and find it easy to activate new

semantic categories. Similarly, homogeneous input would be most stimulating for avoidance-motivated people, as they tend to have a non-flexible thinking style (Elliot, 2008).

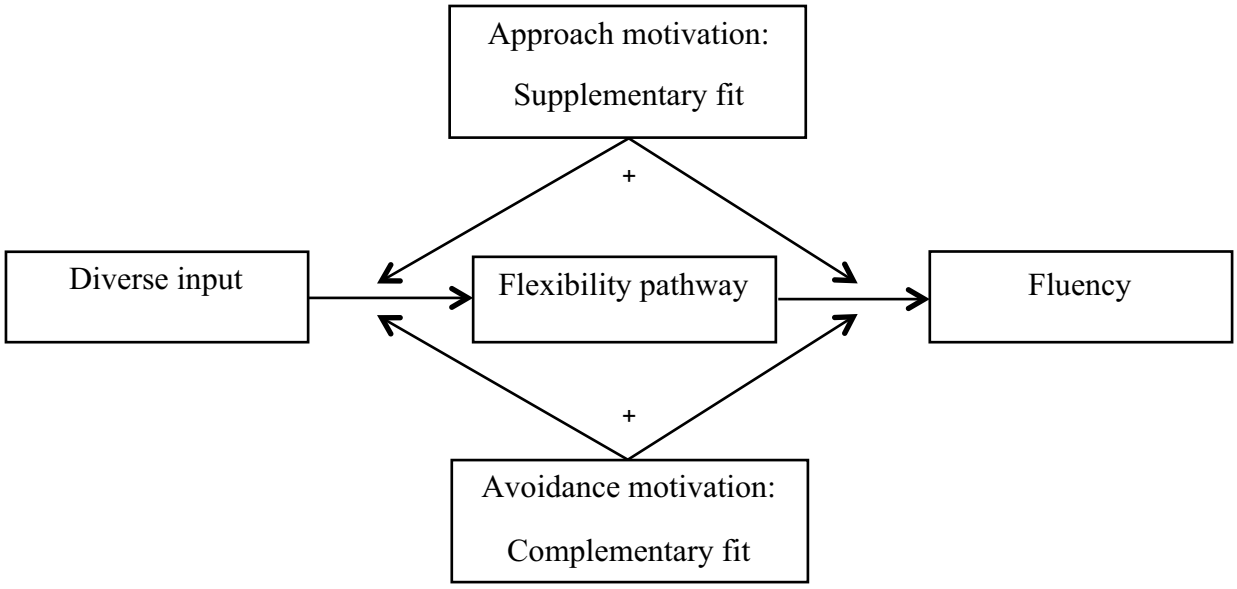

Figure 1a. Theoretical model for diverse input. Fluency as an indirect function of diverse input, mediated by the pathway of flexibility, and moderated by approach-avoidance motivation.

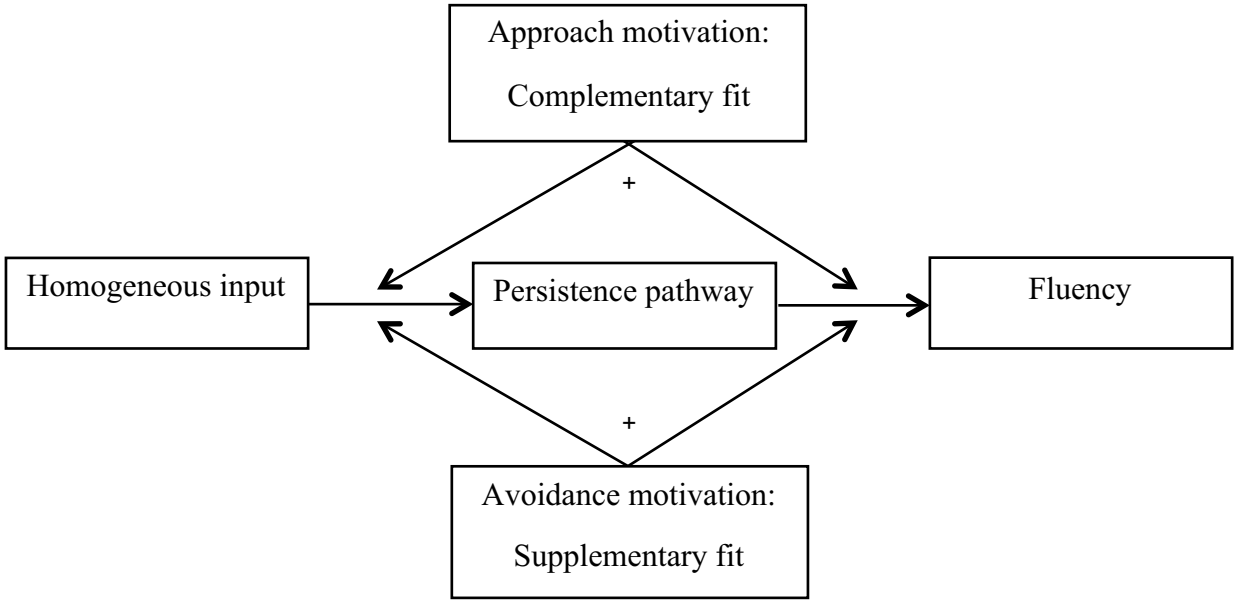

Figure 1b. Theoretical model for homogeneous input. Fluency as an indirect function of homogeneous input, mediated by the pathway of persistence, and moderated by approach-avoidance motivation.

Alternatively, supplementary input may create little added value, as it does not add a new cognitive approach to what people already possess. Because of this, input diversity that creates a *complementary fit* may be especially cognitively stimulating, through stimulating a different type of pathway and increasing the repertoire of possible brainstorming pathways to choose from (see also Figure 1a and 1b, p. 104). If this fit perspective holds, homogeneous input would be beneficial for approach-motivated people, because it stimulates them to use a pathway (in this case, persistence) they might otherwise neglect. Similarly, diverse input would be beneficial for avoidance-motivated people, complementing their non-flexible tendency by increasing their repertoire of semantic categories. Icekon and colleagues (2014) suggest that feeling optimistic increases the creativity of avoidance-motivated people, as it stimulates them to use cognitive flexibility. This would suggest that cognitive flexibility is indeed possible and useful when people are avoidance motivated. Also, because of the strong cognitive investment that is needed to come to creativity via the persistence pathway, people will only engage in this behavior when the benefits outweigh the costs (Roskes et al., 2012). Following the flexibility pathway represented by diverse input could form a welcome addition for these people, requiring less investment of effort and attention.

Our expectations are summarized in our theoretical models (see Figure 1a and 1b, p. 104). Input diversity was expected to predict the pathway used to generate ideas, which in turn predicts cognitive stimulation (that is: fluency, the number of ideas generated). This indirect effect of input on cognitive stimulation was expected to be moderated by approach-avoidance motivation. To test the supplementary and complementary fit perspectives, we conducted two experiments that largely relied on the same method. In Study 1, we followed the presentation of input method of Nijstad and colleagues (2002), by displaying the stimulus ideas on the screen above the writing textbox. However, as this also gave participants the opportunity to ignore input, it could weaken the extent to which input had an effect on idea

generation. In Study 2, therefore, we displayed the stimulus ideas in pop-ups on the screen, which had to be closed to be able to continue typing in ideas (see also, De Jonge et al., 2018). Because of the similarity between the two experiments, we describe the combined methods below.

Methods

Samples and Design

In both experiments, participants brainstormed individually during a 20-minute session on computers located in separate cubicles, generating ideas on the topic of creating a healthy lifestyle. Participants were randomly assigned to receive stimulus ideas from one out of four input diversity settings: No stimulus ideas (Study 1: $n = 26$, Study 2: $n = 30$), homogeneous ideas (Study 1: $n = 28$, Study 2: $n = 31$), diverse uncategorized ideas (Study 1: $n = 26$, Study 2: $n = 30$), diverse categorized ideas (Study 1: $n = 28$, Study 2: $n = 31$). Sample size was determined before any data analysis.

Study 1. A hundred-and-eight psychology students (27% male) of a Dutch university participated in this study for partial course credits. Their ages ranged between 18 and 24 years ($M = 19.85$, $SD = 1.22$).

Study 2. A hundred-and-twenty-two psychology students (34% male) participated in this study for partial course credits. Their ages ranged between 18 and 27 years ($M = 20.37$, $SD = 2.29$).

Procedure

Participants were seated at computers in individual cubicles. Before starting the brainstorming task, the participants filled out a questionnaire about their approach-avoidance motivation; after this they were informed about the four brainstorming rules, and were instructed to keep these in mind while brainstorming (see Osborn, 1957). They were told that during this study they would brainstorm individually to come up with ideas to create a healthy lifestyle. When

the participants were assigned to an input condition, they were informed that stimulus ideas would be provided that were previously generated by other participants. The participants brainstormed for 20 minutes, after which they answered questions about the work process and their demographics. Explorative, additional questions were included concerning individual needs (scale from Van Yperen, Rietzschel, & De Jonge, 2014), task perception and enjoyment, and perceived performance. At the end of the study, the participants were thanked and debriefed. We reported all measures, manipulations and exclusions in these studies.

Manipulation of Input. In order to manipulate the exposure to homogeneous versus diverse input when brainstorming, the stimulus ideas were preprogrammed using ideas from a previous unrelated study (Rietzschel, De Dreu, & Nijstad, 2007). Two independent raters categorized these ideas; they had an agreement percentage of 84%. A category matrix system was used for this, which crossed twelve specific goals (e.g., "improve or maintain bodily fitness") with ten means to reach these goals (e.g., "physical activity"), resulting in 120 different possible categories (for a detailed explanation and examples, see a summary in the Appendix A) (Diehl, 1991). Similar to Nijstad and colleagues (2002), we created four different input files: the first three files were created for the homogeneous input condition, and consisted of ideas from one semantic category containing as least 100 different ideas. We created three different files to ensure that the effects of homogenous input could not be attributed to one specific category. The brainstorming software was designed in such a manner that one of these three files was randomly drawn to provide participants with ideas in the homogeneous input condition. The fourth file was used in the diverse input conditions. This file contained all categories that contained at least five different ideas, to ensure the possibility for structured diverse input. This resulted in 1222 selected ideas, representing 35 categories. From the file used, 80 stimulus ideas were randomly drawn without replacement and displayed one at a time to the participant. In the diverse structured condition, five

different ideas within one category were randomly drawn without replacement and displayed one at a time to the participant, before randomly moving to another category.

Measures

Approach-Avoidance Motivation was measured using the Approach-Avoidance Temperament Questionnaire, containing 6 items per aspect (Elliot & Thrash, 2010). A sample item for approach motivation is “Thinking about the things I want really energizes me”, and for avoidance motivation, “By nature, I am a very nervous person”. Participants responded on a 7-point Likert scale ranging from 1 (‘strongly disagree’) to 7 (‘strongly agree’). Cronbach’s alphas are displayed in Tables 1 and 4.

Flexibility was defined as the number of different categories that the ideas from a participant belonged to. All ideas where coded using the previously explained category matrix system (also see the Appendix A); each idea was rated as belonging to one of the 120 possible categories (Diehl, 1991). The ideas were independently coded by two trained raters who were blind to conditions. The second rater randomly rated 20% of these ideas. As the raters had an agreement of 81% ($\kappa = .78$, 95% CI [.74, .81], $p < .0001$) in Study 1, and 91% ($\kappa = .90$, 95% CI [.87, .92], $p < .0001$) in Study 2, we assumed that the first rater's assessment could be safely used.

Persistence was defined as the average number of ideas *per category* as generated by each participant (i.e., within-category fluency), again using the category matrix system (also see the Appendi Ax; Diehl, 1991).

Fluency was measured as the total number of non-duplicated ideas submitted per participant: i.e., all ideas that did not directly overlap with previously stated ideas or that were identical to the preprogrammed input.

Power Analyses

Power analyses were conducted using the online program by Schoemann, Boulton, and Short (2017), which enables one to estimate the statistical power for complex path analytic models with indirect effects using Monte Carlo simulations (Schoemann, Boulton, & Short, 2017). As a sensitivity analysis is not available, we tested for the studies' power to detect hypothetical correlation values corresponding to full mediation by two medium effects, and using the studies' actual SDs (see also Table 1). Please note that the power could only be investigated for the mediation part of the model (and not for the included moderators). To our knowledge, no power analysis exists at this point to investigate the complete conditional process model (see also, Schoemann et al., 2017).

The power for the indirect path as depicted in Figure 1, p. 104 (condition to fluency via flexibility) was estimated as strong (Study 1 at .82, Study 2 at .88). The power for the indirect path as depicted in Figure 2, p. 104 (condition to fluency via persistency) was estimated as strong (Study 1 at .83, Study 2 at .89). The power for estimating the difference between these paths was estimated as weak (Study 1 and 2 at .05).

Table 1. *Information used to Conduct Sensitivity Power Analyses*

Variable	SD	1	2	3
1. Condition	NA			
2. Flexibility	3.55 (3.21)	. 30		
3. Persistence	1.25 (1.88)	.30	.01	
4. Fluency	16.10 (16.49)	.09	.30	.30
N in study		108 (122)		
No. of bootstrapping used in studies		5000		
No. of Monte Carlo draws for power analysis		20.000		
Confidence level at		95%		

Note. These correlations reflect the hypothetical total effect, which is the sum of the direct effect (which we assume to be zero, under full mediation) and the indirect effect, which here is .30*.30 or .09. The numbers between brackets reflect the information from Study 2.

Results Study 1

Preliminary Analyses

Descriptives, correlations, and Cronbach's alphas of all variables are given in Table 2. The highest correlations were obtained for fluency with flexibility ($r = .73$, $p < .001$) and persistence ($r = .63$, $p < .001$), which suggests that, as expected, use of the flexibility and persistence pathways was positively related to fluency. Sex (with two levels, '-1' for men and '1' for women) and age were evenly distributed across conditions, $\chi^2_{sex}(3, N = 108) = 4.08$, $p = .25$, and $F_{age}(3,104) = 1.94$, $p = .13$[1].

Table 2. *Descriptives, Correlations, and Cronbach's Alphas Study 1- in-text*

Variable	Mean	SD	1	2	3	4	5	6	7	8
1. Gender	NA	NA	NA							
2. Age	19.85	1.22	.03	NA						
3. Condition	NA	NA	-.07	-.13	NA					
4. Approach motiv.	5.26	0.67	.01	.19*	-.20*	.72				
5. Avoidance motiv.	4.21	1.10	.23*	.11	-.19	.07	.78			
6. Flexibility	9.10	3.55	.10	-.01	.52**	-.17	.05	NA		
7. Persistence	3.30	1.25	.21*	-.06	-.04	.07	.11	-.02	NA	
8. Fluency	29.89	16.10	.22*	-.02	.31**	-.05	.13	.73**	.63**	NA

Note. $n = 108$. † $p < .10$; * $p < .05$; ** $p < .01$. When applicable, the corresponding Cronbach's alpha is displayed on the diagonal.

Hypothesis Testing

We used Hayes' (2013) PROCESS SPSS macro (model 58), with a bootstrapping sample size of 5000, to test the assumption of the conditional process model that input diversity would predict fluency through the pathways of flexibility and persistence, and that these indirect paths would be moderated by approach and avoidance motivation (see Figures 1a and 1b). As covariates, we included the other dummy-coded conditions as well as the other (approach vs. avoidance) motivation. Following Hayes (2013), rather than conducting separate moderation and mediation analyses for parts of our model, we tested the entire model in one analysis for each of the independent dummy variables used to compare the two conditions. The PROCESS analysis thus gives insight in the complete moderated mediation model. Importantly, Hayes (2018) notes that the analysis should not be interpreted based on 'the total and direct effects and whether the effect of X becomes nonsignificant after adding the mediator to the model'. Hence, we will not explicitly discuss the separate moderation and mediation outcomes, but for completeness, these can be found in Table 3, Appendix B.

Testing for Cognitive Stimulation Effects

As expected, and similar to Nijstad et al.'s (2002) results, a significant conditional indirect effect was found when comparing the effects of receiving input (homogeneous as well as diverse) versus no input on fluency. On the whole, people who received input rather than no input generated more ideas, as the conditional effects at low, moderate, and high levels were all positive (see Table 4). An ANOVA confirmed this finding $F(3, 104) = 8.03$, $p < .001$, $\eta^2 = .19$ ($M_{\text{no input}} = 17.62$, $M_{\text{homog.}} = 34.04$, $M_{\text{div. uncat.}} = 34.73$, $M_{\text{div. cat.}} = 32.64$).

Table 4a. *Bootstrap Results for Moderated Mediation at Different Levels of the Moderator Study 1 - in-text*

		Homogeneous input vs. NI		Diverse uncategorized input vs. NI		Diverse categorized input vs. NI	
		b-value (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Flexibility path for Approach motivation	*Value*						
Low (-1 SD)	4.58	.19 (2.91)	[-5.65; 5.83]	**14.75 (3.98)**	**[7.13; 22.98]**	**20.56 (3.79)**	**[13.89; 29.05]**
Moderate (M)	5.26	**7.54 (2.63)**	**[2.35; 12.56]**	**14.94 (2.89)**	**[9.78; 21.25]**	**16.82 (3.09)**	**[11.61; 24.13]**
High (+ 1 SD)	5.93	**15.59 (4.43)**	**[7.40; 24.89]**	**15.09 (4.40)**	**[7.66; 25.53]**	**12.61 (4.00)**	**[5.79; 21.94]**
Persistence path for Approach motivation							
Low (-1 SD)	4.58	**11.03 (3.38)**	**[4.60; 17.82]**	6.85 (4.27)	[-1.22; 15.58]	3.63 (3.06)	[-2.18; 9.76]
Moderate (M)	5.26	**13.68 (2.92)**	**[8.47; 20.06]**	**5.49 (2.78)**	**[.72; 11.89]**	3.08 (2.29)	[-1.24; 7.93]
High (+ 1 SD)	5.93	**16.25 (4.16)**	**[9.06; 25.77]**	4.18 (3.31)	[-1.08; 12.47]	2.54 (2.71)	[-2.57; 8.30]

Note. NI = No Input condition. Low, moderate, and high levels of Approach-Avoidance Motivation are constituted as the M-level, ± 1 SD. For approach motivation, 'Low' levels represent an above-mean value on the 7-point Likert scale. If CI does not include zero, the effect is considered statistically significant and is displayed in bold. $n = 108$.

Table 4b (Continued). *Bootstrap Results for Moderated Mediation at Different Levels of the Moderator Study 1 - in-text*

		Homogeneous input vs. NI		Diverse uncategorized input vs. NI		Diverse categorized input vs. NI	
		b-value (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Flexibility path for Avoidance motivation	*Value*						
Low (-1 SD)	3.11	6.65 (4.37)	[-2.55; 14.84]	**15.52 (3.90)**	**[9.33; 25.08]**	**13.00 (3.60)**	**[6.81; 21.55]**
Moderate (M)	4.21	**7.13 (2.78)**	**[1.77; 12.79]**	**14.73 (2.98)**	**[9.57; 21.31]**	**17.45 (3.28)**	**[11.93; 25.24]**
High (+ 1 SD)	5.30	7.63 (4.13)	[-.27; 15.76]	**13.92 (3.79)**	**[6.71; 21.58]**	**21.97 (5.00)**	**[13.04; 32.95]**
Persistence path for Avoidance motivation							
Low (-1 SD)	3.11	**9.96 (4.40)**	**[1.30; 18.73]**	**6.31 (3.42)**	**[.39; 14.05]**	4.91 (2.96)	[-.56; 11.14]
Moderate (M)	4.21	**13.09 (3.00)**	**[7.63; 19.51]**	**5.23 (2.71)**	**[.52; 11.45]**	2.84 (2.30)	[-1.43; 7.69]
High (+ 1 SD)	5.30	**16.15 (2.99)**	**[10.69; 22.60]**	4.19 (3.43)	[-1.65; 12.02]	.81 (3.20)	[-5.24; 7.38]

Table 4c (Continued). *Bootstrap Results for Moderated Mediation at Different Levels of the Moderator Study 1 - in-text*

		Diverse uncategorized input vs. homogeneous input		Diverse categorized input vs. homogeneous input		Diverse categorized input vs. diverse uncategorized input	
		b-value (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Flexibility path for Approach motivation	*Value*						
Low (-1 SD)	4.58	**7.80 (4.02)**	**[.14; 15.95]**	**12.67 (3.47)**	**[6.38; 19.84]**	6.04 (3.55)	[-.25; 13.75]
Moderate (M)	5.26	**7.65 (3.09)**	**[1.94; 14.07]**	**8.52 (3.21)**	**[2.76; 15.47]**	1.56 (3.06)	[-4.37; 7.77]
High (+ 1 SD)	5.93	7.44 (4.50)	[-.57; 17.19]	3.92 (4.47)	[-4.36; 13.73]	-3.38 (4.27)	[-12.19; 4.78]
Persistence path for Approach motivation							
Low (-1 SD)	4.58	-7.06 (4.19)	[-14.78; 1.47]	**-10.26 (3.00)**	**[-16.64; -4.68]**	-1.75 (3.14)	[-8.09; 4.27]
Moderate (M)	5.26	**-8.20 (2.98)**	**[-13.82; -2.07]**	**-10.60 (2.78)**	**[-16.48; -5.55]**	-2.23 (2.49)	[-7.60; 2.30]
High (+ 1 SD)	5.93	**-9.30 (3.25)**	**[-15.62; -2.69]**	**-10.93 (3.73)**	**[-18.99; -4.36]**	-2.68 (3.00)	[-9.13; 2.57]

Table 4d (Continued). *Bootstrap Results for Moderated Mediation at Different Levels of the Moderator Study 1 - in-text*

		Diverse uncategorized input vs. homogeneous input		Diverse categorized input vs. homogeneous input		Diverse categorized input vs. diverse uncategorized input	
		b-value (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Flexibility path for Avoidance motivation	*Value*						
Low (-1 SD)	3.11	**8.39 (3.86)**	**[1.75; 17.15]**	6.01 (3.65)	[-.61; 13.67]	-1.28 (3.49)	[-8.50; 5.50]
Moderate (M)	4.21	**7.54 (3.11)**	**[1.87; 13.99]**	**10.41 (3.36)**	**[4.45; 17.83]**	3.07 (3.20)	[-2.88; 9.85]
High (+ 1 SD)	5.30	6.67 (4.00)	[-1.15; 14.41]	**14.88 (5.00)**	**[5.36; 24.71]**	7.48 (5.00)	[-1.98; 17.62]
Persistence path for Avoidance motivation							
Low (-1 SD)	3.11	**-7.38 (3.43)**	**[-14.11; .59]**	**-8.84 (3.24)**	**[-15.68; -2.92]**	-.56 (2.81)	[-6.64; 4.66]
Moderate (M)	4.21	**-8.29 (2.93)**	**[-13.74; -2.24]**	**-10.76 (2.67)**	**[-16.39; -5.76]**	-2.57 (2.59)	[-8.01; 2.13]
High (+ 1 SD)	5.30	**-9.17 (3.54)**	**[-15.59; -1.54]**	**-12.62 (3.53)**	**[-19.68; -5.82]**	-4.53 (3.65)	[-11.69; 2.44]

Testing the use of Different Pathways

The overall results indicate that the diversity level of input stimulated participants to use the pathway that aligned with this diversity level. Homogeneous input stimulated the use of the persistence pathway, while diverse input stimulated the use of the flexibility pathway, both in turn increasing fluency. As expected, these effects were qualified by individuals' approach-avoidance motivation. Specifically, the stimulated persistence pathway resulted in more fluency both among avoidance-motivated participants (supplementary fit) and approach-motivated participants (complementary fit). Similarly, the flexibility pathway resulted in more fluency both among approach-motivated participants (supplementary fit) and avoidance-motivated participants (complementary fit). These findings are discussed in more detail in the next section.

Comparing Input and no Input Conditions

Homogeneous input (versus no input) stimulated the use of the persistence pathway as an effective way to reach fluency for all participants. The conditional effects at low, moderate, and high levels were all positive for both approach-motivated participants (indicating complementary fit, see Table 4a) and avoidance-motivated participants (indicating supplementary fit, see Table 4b). In addition to this, for approach-motivated participants, implementing their usual flexibility pathway also positively contributed to their fluency[2] (see Table 4a). This suggests that homogeneous input forms a beneficial addition for approach-motivated participants, increasing their repertoire of pathways to reach fluency. Unexpectedly, at medium levels of avoidance motivation, the indirect path through flexibility was significant as well.

Diverse uncategorized input (versus no input) stimulated the use of the flexibility pathway as an effective way to generate ideas for all participants. The conditional effects at all levels were positive for both approach-motivated[2] (supplementary fit, see Table 4a) and

avoidance-motivated participants[4] (complementary fit, see Table 4b). In addition to this, the conditional effect for avoidance motivation indicated that the persistence pathway (their usual pathway) also positively contributed to their fluency.[3,4] This suggests that diverse input forms a beneficial addition for the avoidance-motivated, by stimulating the use of flexibility next to their usual tendency for persistence. Unexpectedly, the medium level of approach motivation showed a positive effect of the use of the persistence pathway to reach fluency.

Diverse categorized input (versus no input) stimulated the use of the flexibility pathway as an effective way to reach fluency for all participants. The conditional effects at low, moderate, and high levels were all positive for both approach-motivated (supplementary fit, see Table 4a) and avoidance-motivated participants [3] (complementary fit, see Table 4b). No effects for persistence were obtained.

Comparing the Input Conditions

Diverse uncategorized input (versus homogeneous input) stimulated the use of the flexibility pathway as a more effective way to reach fluency for all participants; implementing the persistence pathway was less effective. The conditional effects of reaching fluency via flexibility were all positive for both approach-motivated[3] (supplementary fit, see Table 4c) and avoidance-motivated participants [3,4] (complementary fit, see Table 4d); the effects for persistence were all negative.[2]

Diverse categorized input (versus homogeneous input) showed a pattern of effects similar to those of receiving diverse uncategorized input. Again, implementing the flexibility pathway seemed a more effective way to reach fluency for all participants; implementing the persistence pathway was less effective. The conditional effects of reaching fluency via flexibility were all positive for both approach-[3,4] (supplementary fit, see Table 4c) and avoidance-motivated participants [2] (complementary fit, see Table 4d), whereas the effects for persistence were all negative for approach- and avoidance-motivated participants.[2]

Diverse categorized input (versus uncategorized input) indicated results similar to those of Nijstad et al. (2002). No significant differences between the diverse categorized and uncategorized input conditions were obtained for the use of the flexibility or the persistence pathway to generate ideas. Both diverse input conditions seem to result in the same type of effects (see Table 4c and 2d).

Discussion Study 1

The overall results of Study 1 indicate that both approach- and avoidance-motivated participants effectively implemented the cognitive pathway that aligned with the diversity level of the input, which in turn increased their fluency. This occurred whether the stimulated pathway supplemented or complemented the individual's preference, hence supporting both fit perspectives. Supporting the supplementary fit model, diverse input stimulated the use of the flexibility pathway in approach-motivated people, while homogeneous input stimulated the use of the persistence pathway in avoidance-motivated people, both in turn increasing fluency. The complementary fit model was also supported: homogeneous input stimulated the use of persistence as an additional pathway in approach-motivated people, resulting in the effective use of both this and their usual flexibility pathway to reach fluency. Similarly, diverse input stimulated the use of the flexibility pathway in avoidance-motivated people, which in turn increased their idea generation.

It seems that both approach- and avoidance-motivated people have a tendency to use a specific pathway, but that the input received has a strong effect on the cognitive pathway(s) used, and that both approach- and avoidance-motivated people adapt their cognitive style to the input received. Importantly, when the input stimulated a pathway that differed from the individual's usual tendency (complementary fit), a beneficial add-on effect occurred for the approach-motivated and sometimes for the avoidance-motivated. In such instances, participants implemented not only the pathway that was activated by the input, but

additionally implemented their usual pathway, and both pathways increased the number of ideas generated. To test whether we could replicate these findings, a second study was conducted in which the stimulus ideas appeared in pop-ups on the screen, which had to be closed to be able to continue typing in ideas.

Results Study 2

Preliminary Analyses

Descriptives, correlations, and Cronbach's alphas of all variables are given in Table 5. Similar to Study 1, the highest correlations were obtained for fluency with flexibility ($r = .67$ $p < .001$) and persistence ($r = .63$ $p = .00$). Sex and age were evenly distributed across conditions, $\chi^2_{sex}(3, N = 122) = 2.14$, $p = .54$, and $F_{age}(3, 122) = .26$, $p = .86$.

Hypothesis Testing

Similar to Study 1, we used Hayes' (2013) PROCESS SPSS macro (model 58), with a bootstrapping sample size of 5000, to test the assumption of the conditional process model that input diversity would predict fluency through the pathways of flexibility and persistence, and that these indirect paths would be moderated by approach and avoidance motivation (see Figures 1a and 1b). Again, for completeness, the separate moderation and mediation outcomes can be found in Table 6, Appendix C.

Testing for Cognitive Stimulation Effects

As expected, and similar to Study 1, a significant conditional indirect effect was found when comparing the effect of receiving input (homogeneous input and diverse input conditions) versus no input on fluency. On the whole, people who received input rather than no input generated more ideas, as the conditional effects at low, moderate, and high levels were all positive (see Table 7). An ANOVA confirmed this finding $F(3, 118) = 9.23$, $p < .001$, $\eta^2 = .19$ ($M_{\text{no input}} = 16.00$, $M_{\text{homog.}} = 33.03$, $M_{\text{div. uncat.}} = 33.17$, $M_{\text{div. cat.}} = 31.48$).

Table 5. *Descriptives, Correlations, and Cronbach's Alphas Study 2 - pop-up*

Variable	Mean	SD	1	2	3	4	5	6	7	8
1. Gender	NA	NA	NA							
2. Age	20.37	2.29	-.36**	NA						
3. Condition	NA	NA	.03	.05	NA					
4. Approach motiv.	5.40	0.67	.10	.02	.04	.79				
5. Avoidance motiv.	4.07	1.08	.18*	-.05	-.03	.02	.75			
6. Flexibility	8.07	3.21	.02	.02	.43**	-.03	.14	NA		
7. Persistence	3.59	1.88	.18 †	-.03	.02	.15	-.08	-.04	NA	
8. Fluency	28.48	16.49	.12	-.04	.31**	.06	-.04	.67**	.63**	NA

Note. $n = 122$. † $p < .10$; * $p < .05$; ** $p < .01$. When applicable, the corresponding Cronbach's alpha is displayed on the diagonal.

Table 7a. *Bootstrap Results for Moderated Mediation at Different Levels of the Moderator Study 2 - pop-up*

		Homogeneous input vs. NI		Diverse uncategorized input vs. NI		Diverse categorized input vs. NI	
		b-value (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Flexibility path for Approach motivation	*Value*						
Low (-1 SD)	4.72	2.33 (4.05)	[-6.20; 9.86]	**11.44 (3.39)**	**[5.86; 19.89]**	**11.48 (3.75)**	**[5.38; 20.18]**
Moderate (M)	5.40	4.07 (2.31)	[-.27; 8.75]	**10.83 (2.49)**	**[6.64; 16.67]**	**13.04 (2.86)**	**[8.13; 19.60]**
High (+ 1 SD)	6.07	5.83 (4.13)	[-1.34; 14.82]	**10.22 (3.43)**	**[4.02; 17.48]**	**14.61 (3.56)**	**[8.33; 22.42]**
Persistence path for Approach motivation							
Low (-1 SD)	4.72	8.35 (4.83)	[-1.59; 17.49]	**7.24 (3.65)**	**[.95; 15.12]**	4.59 (3.35)	[-.97; 12.53]
Moderate (M)	5.40	**13.43 (2.73)**	**[8.03; 18.72]**	**5.56 (2.24)**	**[1.16; 9.87]**	3.29 (2.00)	[-.52; 7.45]
High (+ 1 SD)	6.07	**17.83 (3.62)**	**[10.15; 24.64]**	4.04 (2.82)	[-1.88; 9.38]	2.11 (2.41)	[-2.93; 6.68]

Note. NI = No Input condition. Low, moderate, and high levels of Approach-Avoidance Motivation are constituted as the M-level, ± 1 SD. For approach motivation, 'Low' levels represent an above-mean value on the 7-point Likert scale. If CI does not include zero, the moderated mediation effect is considered statistically significant and is displayed in bold. n = 122.

Table 7b (Continued). *Bootstrap Results for Moderated Mediation at Different Levels of the Moderator Study 2 - pop-up*

		Homogeneous input vs. NI		Diverse uncategorized input vs. NI		Diverse categorized input vs. NI	
		b-value (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Flexibility path for Avoidance motivation	*Value*						
Low (-1 SD)	2.99	5.00 (2.82)	[-.63; 10.67]	**10.26 (3.48)**	**[3.66; 17.47]**	**12.34 (3.61)**	**[5.82; 19.81]**
Moderate (M)	4.07	4.13 (2.33)	[-.30; 8.94]	**10.76 (2.42)**	**[6.50; 16.19]**	**12.86 (2.81)**	**[7.82; 18.82]**
High (+ 1 SD)	5.14	3.29 (3.43)	[-3.21; 10.35]	**11.24 (3.64)**	**[4.80; 19.11]**	**13.36 (4.12)**	**[5.67; 21.89]**
Persistence path for Avoidance motivation							
Low (-1 SD)	2.99	**18.74 (3.93)**	**[11.44; 26.82]**	**6.02 (3.08)**	**[.02; 12.28]**	4.13 (3.14)	[-1.78; 10.60]
Moderate (M)	4.07	**13.77 (2.73)**	**[8.53; 19.26]**	**5.63 (2.21)**	**[1.20; 9.77]**	3.25 (1.95)	[-.49; 7.37]
High (+ 1 SD)	5.14	**9.53 (3.31)**	**[3.23; 16.43]**	**5.16 (3.22)**	**[.34; 12.20]**	2.48 (2.40)	[-1.38; 8.38]

Table 7c (Continued). *Bootstrap Results for Moderated Mediation at Different Levels of the Moderator Study 2 - pop-up*

		Diverse uncategorized input vs. homogeneous input		Diverse categorized input vs. homogeneous input		Diverse categorized input vs. diverse uncategorized input	
		b-value (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Flexibility path for Approach motivation	*Value*						
Low (-1 SD)	4.72	**7.32 (3.32)**	**[11.81; 5.22]**	**7.27 (3.71)**	**[.86; 15.78]**	.63 (3.36)	[-5.74; 7.47]
Moderate (M)	5.40	**6.70 (2.57)**	**[2.05; 12,28]**	**8.81 (3.04)**	**[3.44; 15.46]**	2.16 (2.84)	[-3.46; 7.67]
High (+ 1 SD)	6.07	6.08 (3.47)	[-.37; 13.27]	**10.37 (3.76)**	**[3.37; 18.32]**	3.69 (2.73)	[-3.39; 11.15]
Persistence path for Approach motivation							
Low (-1 SD)	4.72	**-7.25 (3.61)**	**[-14.88; -.58]**	**-.90 (3.72)**	**[-17.66; -2.84]**	-1.39 (3.14)	[-7.13; 5.46]
Moderate (M)	5.40	**-8.08 (2.92)**	**[-13.66; -2.25]**	**-10.35 (2.78)**	**[-15.66; -4.86]**	-2.34 (1.99)	[-6.20; 1.62]
High (+ 1 SD)	6.07	**-8.75 (3.23)**	**[-15.15; -2.30]**	**-10.69 (2.82)**	**[-16.00; -4.81]**	-3.17 (2.16)	[-7.42; 1.31]

Table 7d (Continued). *Bootstrap Results for Moderated Mediation at Different Levels of the Moderator Study 2 - pop-up*

		Diverse uncategorized input vs. homogeneous input		Diverse categorized input vs. homogeneous input		Diverse categorized input vs. diverse uncategorized input	
		b-value (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Flexibility path for Avoidance motivation	*Value*						
Low (-1 SD)	2.99	6.10 (3.44)	[-.78; 12.82]	**8.18 (3.61)**	**[1.25; 15.48]**	1.49 (3.59)	[-5.61; 8.41]
Moderate (M)	4.07	**6.67 (2.46)**	**[2.02; 11.72]**	**8.77 (2.96)**	**[3.19; 14.89]**	2.18 (2.88)	[-3.46; 7.78]
High (+ 1 SD)	5.14	**7.21 (3.61)**	**[.83; 15.12]**	**9.33 (4.34)**	**[.98; 17.98]**	2.86 (4.36)	[-6.14; 11.16]
Persistence path for Avoidance motivation							
Low (-1 SD)	2.99	**-9.30 (3.91)**	**[-17.01; -1.77]**	**-11.20 (3.62)**	**[-18.40; -4.15]**	-2.20 (2.97)	[-7.85; 3.88]
Moderate (M)	4.07	**-7.99 (2.87)**	**[-13.53; -2.41]**	**-10.36 (2.72)**	**[-15.46; -4.95]**	-2.37 (1.93)	[-5.98; 1.56]
High (+ 1 SD)	5.14	**-6.74 (2.91)**	**[-12.29; -.84]**	**-9.42 (2.66)**	**[-14.75; -4.55]**	-2.43 (2.08)	[-6.40; 1.77]

Testing the use of Different Pathways: Comparing Input and no Input Conditions

Homogeneous input (versus no input) stimulated the use of the persistence pathway as an effective way to reach fluency for all participants. The conditional effects at low, moderate, and high levels were all positive for both approach-motivated[2] (complementary fit, see Table 7a) and avoidance-motivated participants[3] (supplementary fit, see Table 7b). No effects for flexibility were present.

Diverse uncategorized input (versus no input) stimulated the use of the flexibility pathway, and also the use of the persistence pathway, as an effective way to generate ideas for all participants. The conditional effects for flexibility were all positive for both approach-motivated[3] (supplementary fit, see Table 7c) and avoidance-motivated participants[2] (complementary fit, see Table 7d). The effects for persistence were also all positive for both approach-motivated[3,4] (see Table 7c) and avoidance-motivated participants[3] (see Table 7d). This suggests that diverse input forms a beneficial addition for the avoidance-motivated, by stimulating the use of flexibility next to their usual tendency for persistence. Note that the unexpected positive effect of the persistence pathway for approach motivation (a pathway neither stimulated by nor representing their usual tendency) was not significant for the highest level of approach motivation.

Diverse categorized input (versus no input) stimulated the use of the flexibility pathway as an effective way to generate ideas for all participants. The conditional effects at low, moderate, and high levels were all positive for both approach-motivated (supplementary fit, see Table 7a) and avoidance-motivated participants[2] (complementary fit, see Table 7b). No effects for persistence were present.

Comparing the Input Conditions

Diverse uncategorized input (versus homogeneous input) stimulated the use of the flexibility pathway as an effective way to reach fluency for all participants, while

implementing the persistence pathway was less effective. The conditional effects for flexibility were all positive for both approach-motivated [3,4] (supplementary fit, see Table 7c) and avoidance-motivated participants[2] (complementary fit, see Table 7d), and the effects for persistence were all negative for both approach-motivated[2] (see Table 7c) and avoidance-motivated participants[3] (see Table 7d).

Diverse categorized input (versus homogeneous input) produced a pattern of effects similar to that of diverse uncategorized input. Again, implementing the flexibility pathway seemed a more effective way of reaching fluency for all participants, while implementing the persistence pathway was less effective. The conditional effects for flexibility were all positive for both approach-motivated [2] (supplementary fit, see Table 7c) and avoidance-motivated participants[2] (complementary fit, see Table 7d), whereas the effects for persistence were all negative for approach-motivated [2] (see Table 7c) and avoidance-motivated participants [3] (see Table 7d).

Diverse categorized input (versus uncategorized input) showed results similar to those of Study 1. No significant differences were obtained for the use of flexibility or persistence to generate ideas. Both conditions seem to result in the same type of effects (see Table 7c and 5d).

Discussion Study 2

The overall results of Study 2 are in line with those of Study 1, indicating that input stimulated participants to use the pathway that aligned with its diversity level, supporting both the supplementary and complementary fit models. In Study 1, a beneficial add-on effect occurred for the approach- and, sometimes, for the avoidance-motivated: these participants used both cognitive pathways effectively when they received complementary input. In Study 2, this beneficial add-on effect disappeared for the approach-motivated. All participants effectively used the pathway that was stimulated by the input, which in turn increased their

fluency. When the pathway that was stimulated by the input differed from the individual's usual tendency (complementary fit), participants did not implement their usual cognitive pathway next to this. In the exception to this, avoidance-motivated participants who received diverse uncategorized input (complementary fit), also effectively implemented their usual persistence pathway in this situation. It seems that the input received has a strong effect on the cognitive pathway used, and that both the approach- and the avoidance-motivated adapt their cognitive style to the input received.

General Discussion

People often work together on a variety of tasks, including idea generation in brainstorming sessions (cf. Nijstad & Stroebe, 2006). Given that group work is ubiquitous in modern organizations, and that group brainstorming remains highly popular despite the risks of productivity loss, it is important to understand more about the factors that contribute to (or inhibit) creative idea generation. In the present research, we focused on individual differences in approach-avoidance motivation and the tendency to use a specific cognitive pathway when brainstorming, in order to investigate what type of input would be optimal for cognitive stimulation to occur. We replicated the main effects of input found by Nijstad and colleagues (2002), that receiving input from others can stimulate and improve idea generation, probably because less effort is needed to form search cues to activate relevant information. Also, we replicated their findings related to the type of input: we found that homogeneous input increases persistence and depth of idea generation, whereas diverse input increases flexibility and breath.

By extending De Dreu et al.'s (2008) DPCM (Dual Pathway to Creativity Model), which describes people's use of and preferences for different cognitive pathways, we derived a series of hypotheses regarding the possible fit between specific types of input and individual characteristics. Our overall findings suggest that both approach-motivated and avoidance-

motivated people seem to use input as an important additional search cue, and are stimulated to follow the cognitive pathway that aligns with the diversity level of the input. Hence, rather than specifically requiring supplementary fit or complementary fit between the input and people's usual pathway; both can work effectively, as long as one (also) implements the cognitive strategy reflected by the input. Diverse input from various mental categories stimulated the use of the flexibility pathway and increased fluency among both approach-motivated (supplementary fit) and avoidance-motivated participants (complementary fit). Similarly, homogeneous input from one mental category stimulated the use of the persistence pathway and increased fluency among both avoidance-motivated (supplementary fit) and approach-motivated participants (complementary fit). These results are very interesting. Although the literature has consistently shown a strong link between approach-motivation and the flexibility pathway, and for avoidance-motivation and the persistence pathway (see for example Baas et al., 2013; Friedman and Förster, 2000, 2002, 2005; Nijstad et al., 2010), our results highlight the great extent to which the pathway used is (additionally) affected by the input. In instances of complementary fit – i.e. when the pathway stimulated by the input was different from one's usual tendency -, the cognitive pathway reflected by the input sometimes formed a beneficial addition. In such instances, participants implemented not only the pathway that was activated by the input, but additionally implemented their usual pathway, and both pathways increased the number of ideas generated. But most often, the stimulated pathway formed a better alternative for attaining fluency. It thus seems that the input received has a strong effect on the cognitive pathway used, and that both approach- and avoidance-motivated people adapt their cognitive pathway to the input received.

Comparing Conditions

From the overall pattern of results per condition, it appears that the diverse categorized input (vs. no input) yields the most consistent findings. Here, the pathway used seems to align exclusively with the type of input, such that both approach- and avoidance-motivated people use the flexibility pathway to come to fluency.

For the homogeneous input (vs. no input) condition, again the type of input seems to be dominant, in that both approach- and avoidance-motivated people use the persistence pathway to come to fluency. Further, Study 1 indicates that approach-motivated people also implemented their usual flexibility pathway, and were thus able to effectively use *both* cognitive pathways to come to fluency. This additional effect of the individual's motivation was not found in Study 2, perhaps because the input was conveyed in a manner that was difficult to ignore. Receiving pop-ups that first had to be closed may have made it difficult for participants to still implement their usual flexibility pathway when presented (or confronted) with homogeneous input from one mental category. The implications of these effects are discussed below (see 'Theoretical Implications and Future Directions'). Unexpectedly, in Study 1, participants with an average level of avoidance motivation also used the flexibility pathway (next to the persistence pathway) to come to fluency. This was surprising, as this pathway was neither stimulated by the input nor represented their usual tendency.

The least consistent pattern of results was found for the diverse uncategorized input (vs. no input) condition, which can be seen as the most extreme condition. Here, participants received all kinds of different ideas that were constantly and randomly drawn from different categories, without any clustering whatsoever. For all participants, this resulted in use of the flexibility pathway to come to fluency. Moreover, avoidance-motivated people adopted their usual persistence strategy (for all but the highest level of avoidance motivation in Study 1), and were thus able to effectively use *both* cognitive pathways to come to fluency.

Surprisingly, participants with an average level of approach motivation (as well as those with a low level in Study 2) also additionally used the persistence pathway when receiving diverse uncategorized input (versus no input); this was not stimulated by the input nor did it represent their usual tendency.

Practical Implications

It seems that following the cognitive pathway stimulated by the input works most beneficially for idea generation, even if this pathway differs from people's usual tendency. In practice, this finding could be implemented in two ways. When the type of input that will be shared is clear to team members, or is even controlled using technologies such as electronic brainstorming, people could be trained to adapt their cognitive strategy to the input received. People could be informed about these two possible cognitive pathways to fluency, and told that these seem to work well for different types of input. Both approach-motivated and avoidance-motivated people seemed to be able to take on a new cognitive pathway that differed from their usual tendency, possibly because is it easy to go along with the type of input received to generate similar ideas. This reduces the cognitive effort related to implementing a new pathway, and may enhance the likelihood of people successfully using a cognitive pathway that differs from their usual tendency.

However, there are also circumstances in which it is unclear (beforehand) what type of input will be shared, or in which the diversity level cannot be controlled using technologies. In these situations it might be useful to train people to implement the flexibility pathway in idea generation. We suspect that if one of the team members takes on a flexibility approach, the group will automatically share diverse rather than homogenous input. Further, the persistent pathway requires high cognitive investments to systematically focus attention (De Dreu et al., 2008; Nijstad et al., 2010); it can, therefore, be useful to stimulate people to use the flexibility pathway instead.

Theoretical Implications and Future Directions

Extending the DPCM (De Dreu et al., 2008) provided us with further insight into cognitive stimulation effects from input. Specifically, the cognitive pathway a person uses to come to idea generation seems to depend not only on the person's personal characteristics and preference for a specific cognitive pathway, but more strongly on the influence they experience from (the input of) others. These research findings provide a starting point for further theoretical elaboration, and highlight the effect of both the intrapersonal and the interpersonal level in cognitive stimulation. One fruitful possibility is to further extend the DPCM by including the group level, which might be called the *Dual Pathway to Creativity in Groups Model* (DPCGM). To this end, the view of groups as information processors provides a useful basis (Hinsz, Tindale, & Vollrath, 1997). It indicates that the sharing of ideas and information affects both individual- and group-level outcomes, and that cognitive processes occur not only within but also among group members. From this, we suggest that the DPCGM should include the aspect of input and its characteristics (such as diversity or novelty; see also, De Jonge et al., 2018) and represent the cognitive pathways of flexibility and persistence on the group level. We speculate that this group-level tendency would depend both on the composition of the group members' intrapersonal characteristics and preference for a specific cognitive pathway (i.e., individual differences and states as included in the DPCM), and on the interpersonal characteristics and the influence people experience from (the input of) each other. As further research is needed to test these interpersonal and group-level positions, we invite other researchers to investigate and further elaborate on the DPCGM.

Another possible future direction is to investigate the underlying process of how specific ideas from others stimulate the generation of additional ideas. This would be useful, as the overall results indicate that the diversity level of the input stimulates people to (also) use the congruent cognitive pathway to come to fluency, probably because the stimulated

categories are easily accessible. Cognitive stimulation is normally assessed at a global level (e.g., differences in productivity, flexibility, and persistence), but it should be possible to also investigate it on the level of ideas or strings of ideas within participants. Creating such a measure could provide more insight into which aspects of input have stimulating effects, and how people continue brainstorming from input. Additionally, it would be interesting to investigate under what circumstances input stimulates the use of an additional cognitive pathway, rather than interfering with people's usual tendency. If the manner in which input is conveyed affects the usability of cognitive pathways, it is important to take this into account when determining the format of idea sharing in electronic brainstorming, in order to maximize the effectiveness of input.

Finally, in the present studies we focused on individual differences in approach-avoidance motivation. Although these motivations are important predictors and moderators in the context of creative performance, work motivation, and group interactions (De Dreu et al., 2008; Elliot, 2008), it would be interesting to also address the role of other individual differences in states and traits, such as mood, processing mode, openness to experience, and extraversion-introversion (Baas, Roskes, Sligte, Nijstad, & De Dreu, 2013; Baer, 2010; Jung, Lee, & Karsten, 2012; Nijstad et al., 2010). Mapping the ways in which various individual differences moderate cognitive stimulation may also help us understand the underlying mechanisms and identify further boundary conditions for stimulation to occur.

Conclusion

We extended the DPCM (De Dreu et al., 2008), which provided us with further insight into cognitive stimulation effects from input. The current findings indicate that both approach-motivated and avoidance-motivated people use input as an important additional search cue to come to further idea generation, and are stimulated to follow the cognitive pathway that aligns with the diversity level of the input. Sometimes, the cognitive pathway

reflected by the input forms a beneficial addition that is used next to people's usual pathway; other times, the stimulated pathway forms a better alternative for cognitive stimulation to occur. These research findings provide a starting point for further theoretical elaboration, and highlight the importance of both the intrapersonal and the interpersonal level in cognitive stimulation. Because of this, we encourage other researchers to investigate and further elaborate on the inclusion of group-level predictions in the proposed DPCGM.

Footnotes

[1]Some participants generated extremely little (< 10) or a lot of ideas (> 55) (n = 15 in Study 1, n = 19 in Study 2). As analyzing the results without these participants resulted in similar outcomes, we decided to keep all participants in the analysis. If anything changed, the pattern of results became even more consistent for the different levels of motivations in both studies.

[2]This moderated mediation effect indicated stronger effects for higher levels of the motivation.

[3]This moderated mediation effect was strongest for medium levels of the motivation.

[4]Note that the effect became non-significant at the highest level of the motivation.

[5]The complete category matrix system including all examples per category can be received by contacting the first author.

5

General Discussion

CHAPTER 5

General Discussion

The core focus in this dissertation was on how to optimally match person and context to ensure that people perceive the creativity in novel ideas, and to stimulate optimal creative performance and task enjoyment. We expected that 'one size does not fit all', and that different people would thrive in different contexts. Following the interactionist perspective on creativity (Woodman, Sawyer, & Griffin, 1993), several open questions remained regarding the antecedents and consequences of creative performance. First, although the identification of novel ideas as creative is key to new product development and innovation (Zhou & Hoever, 2014), little is known of what constitutes a creative idea, why, and for whom, and for what purpose. Hence, we found it important to investigate how to create the optimal circumstances for people to attain creative idea generation, and when creative ideas are generated, to ensure that they are also recognized as such. This increases the likelihood that individuals, teams, and organizations can benefit from the creative ideas generated. By investigating these questions (Chapter 2), we found that the perception of creativity seems to imply some sort of valuation or appreciation of the idea (Runco & Smith, 1992), and is affected by the perception of novelty, feasibility, positive surprise, and disruptiveness. Perceptions of creativity were constituted similarly for laypeople and experts, and affected the expectations of success of novel ideas, willingness to endorse their implementation, and their perceived added value for further idea generation.

Second, knowing this, we tested if and how well people were actually able to use novel ideas as a starting point for further idea generation, and expected and found that this differed per person (Chapter 3). Given that group work is ubiquitous in modern organizations, and that group brainstorming remains highly popular despite the risks of productivity loss (cf. Nijstad & Stroebe, 2006), we found it important to understand more about the factors that contribute

to (or inhibit) creative idea generation. Although recognizing creativity revolves around perceptions of other people's ideas, whereas cognitive stimulation concerns generating ideas oneself, our findings suggest that the two processes are strongly interrelated. We expected and found that the indirect effect of input novelty on cognitive stimulation through perceived creativity was affected by individual differences: in this case, people's psychological needs for structure and autonomy.

Last, we focused on individual differences in approach-avoidance motivation and people's tendency to use a specific cognitive pathway when brainstorming, in order to investigate what type of input (diverse or homogenous) would be optimal for cognitive stimulation to occur (Chapter 4). Our findings suggest that both approach-motivated and avoidance-motivated people seem to use input as an important additional search cue, and are stimulated to follow the cognitive pathway that aligns with the diversity level of the input. It thus seems that the input received has a strong effect on the cognitive pathway used, and that both approach- and avoidance-motivated people adapt their cognitive pathway to the input received. The following section gives an in-depth overview of the main research questions answered and the contributions per chapter of this dissertation.

Overview of Main Findings and Contributions

1. *Does our common scholarly definition of creativity go hand-in-hand with people's perception of what constitutes a creative idea*? Not necessarily, as we saw in Chapter 2. In Chapter 2, we investigated and found in three studies that people's perception of creativity includes more elements than novelty and feasibility alone (our common definition of creativity, cf. Hennessey & Amabile, 2010). Perceiving ideas as creative constitutes a positive evaluation of such ideas, but novel ideas may not always evoke this perception. We found it important to know how the perception of creativity is formed, as perceiving the creativity in proposed ideas forms a crucial first step to investigating, selecting, and implementing these

ideas (Bunzeck & Düzel, 2006; Johnston, Hawley, Plewe, Elliott, & DeWitt, 1990; Schulz, 2001; Zhou, May Wang, Jiwen Song, & Wu, 2016). We showed that perceiving ideas as creative relates to a perception of high novelty, feasibility, and positive surprise, and low disruptiveness. Thus, ideas are seen as creative when they are perceived as welcome, new, and useful additions to the task at hand. However, as novel ideas are less closely related to one's own mental images (Dugosh & Paulus, 2005) and existing knowledge, this lowers the perception of novel ideas as being feasible, and increases the perception of their disruptiveness. Also, for both laypeople and people in creative industries, this serially affected the expectation of success of novel ideas, the willingness to endorse their implementation, and their perceived added value as a starting point for idea generation.

2. Is novel input stimulating in generating creative ideas? Not for everyone, as we saw in Chapter 3. In Chapter 3, we showed that perceiving the creativity in novel ideas forms a necessary first step to be cognitively stimulated by the input (that is, to achieve more productivity and idea diversity, to increase task enjoyment, and not to feel blocked). Here, we aimed to address the inconsistent finding in the brainstorming literature that cognitive stimulation sometimes results from novel input (e.g., Berg, 2014), and other times from non-novel input (e.g., Dugosh & Paulus, 2005). Although one might intuitively expect that idea novelty enhances cognitive stimulation (see, for example, Connolly, Routhieaux, & Schneider, 1993), its role appears to be complex. With three experimental studies, we demonstrated that the link between input novelty and cognitive stimulation partly depends on people's psychological needs for structure and autonomy. Additionally, we showed that the perceived creativity of the input mediates this relationship, in line with previous research indicating that the role of novelty in the perception of creativity is less than straightforward (e.g., Mueller, Wakslak, & Krishnan, 2014; De Jonge, Rietzschel, Van Yperen, & Mueller, 2019 (Chapter 2)). The effect of novel input (vs. non-novel input), through perceived

creativity, on cognitive stimulation was stronger for people who were either low in need for structure or high in need for autonomy. Also, when the input people received did not fit their needs, they experienced less psychological cognitive stimulation from this input (i.e., less task enjoyment and feeling more blocked) compared with when they did not receive any input. Hence, the level of cognitive stimulation in brainstorming seems to depend on input novelty, perceived creativity, and people's psychological needs.

3. How do we use input to come up with creative ideas? In Chapter 4, we showed that input diversity and individual differences determine the effectiveness of two cognitive pathways to generate ideas when brainstorming. Previous research indicates that input can result in cognitive stimulation both when it covers a wide and when it covers a small range of perspectives (i.e., is high or low in diversity) (Nijstad, Stroebe, & Lodewijkx, 2002). Yet, the extent to which input does so may depend on individual differences (also see, De Jonge, Rietzschel, & Van Yperen, 2018 (Chapter 3)) that are associated with a preference for a particular cognitive pathway towards creativity. Approach-motivated people tend to use a flexible cognitive pathway that is characterized by generating ideas from diverse semantic categories, whereas avoidance-motivated people use a persistent cognitive pathway by generating ideas from deeper within few semantic categories. We argued and demonstrated in two experimental studies that both the type of input and people's approach-avoidance motivation determine which cognitive pathway results in creative idea generation. Diverse input stimulated the use of the flexibility pathway, while homogeneous input stimulated the use of the persistence pathway, both in turn increasing idea generation. Sometimes, the cognitive pathway reflected by the input formed a beneficial addition that was used next to people's usual pathway; other times, the stimulated pathway formed a better alternative for cognitive stimulation to occur. These findings indicate that both approach-motivated and avoidance-motivated people use input as an important additional search cue to achieve further

idea generation, and are stimulated to follow the cognitive pathway that aligns with the diversity level of the input.

Limitations

While the findings of the current dissertation may already be useful and insightful for brainstorming, it is important to also highlight some general limitations. In the current dissertation, we often used a simulated group brainstorming situation. This format was chosen as it allowed us to control the type of input received, and enabled us to investigate how different types of input affect one's cognitive stimulation and idea generation. A limitation of this simulated setting is that we cannot draw inferences about group level creativity. Also, we only looked at the effects of task relevant information (that is, receiving information that is in line with the task goal). Participants received ideas, but did not have the ability to communicate thoughts or questions and could not synchronously chat with each other. This decision was made in order to create a controlled experimental setting in which the type of ideas received could be manipulated. Future research could extend the current investigations by moving towards an actual group brainstorming situation and allowing for synchronous communication. Besides sharing ideas, this will likely also result in communicating emotional connotations, expectations, values, and attitudes. Additionally, it is not uncommon for people to share and receive entirely irrelevant information that require one's attention in order to determine its relevance for one's job (Forster & Lavie, 2008). Including these elements will give further insight in the effect such information sharing has on further idea generation and creative performance.

Finally, in most studies, participants were led to believe they were working together with another participant on the task at hand. As participants never met the other participant, had no shared past, and had no expectation of working together in the future, these (fictitious) ad hoc teams were solely formed for the duration of the study and may differ in important

ways from teams formed in the work setting. Future studies could investigate brainstorming effectiveness in teams that are created for a much longer time, have a shared past, and an expected shared future. In teams with a shared past, aspects such as likeability, and the level of trust and familiarity with each other, will additionally affect work perceptions (Alge, Wiethoff, & Klein, 2003), and may affect the willingness and effectiveness of group brainstorming as well.

Avenues for Future Research

Although our results add to our understanding of how perceptions of creativity are formed, and provide insight into the circumstances that increase creative performance, more research is obviously needed. Several avenues for future research arise from the interactionist perspective on creativity (Woodman et al., 1993), and from aiming to bridge streams of research on creativity and innovation.

As elaborated in Chapter 1, the interactionist perspective on creativity describes creativity as evolving from a complex actor-context interaction (Woodman et al., 1993). In the current dissertation, the actor component was investigated from the individuals' perspective. Other levels at which the actor component could be investigated are at the team or organizational level, and doing so could be a great avenue for future research. "At the team level, creativity is a consequence of individual creative behavior, the interaction between the group members (e.g., group composition), group characteristics (e.g., norms, size), team processes, and contextual influences (e.g., organizational culture, reward systems). At the organizational level, innovation is a function of both individual and group creativity (Anderson, Potočnik, & Zhou, 2014, p.1300)". In line with this, both Chapter 3 and Chapter 4 highlighted that cognitive stimulation not only depends on people's personal characteristics and their preference for a specific cognitive pathway, but also depends strongly on the influence people experience from the input of others. These research findings provide a

starting point for further theoretical elaboration, and highlight the effect of both the individual and the team level in cognitive stimulation. Moving towards the team level, future research suggestions such as those mentioned in Chapter 4 could be very relevant to investigate. One fruitful possibility is to further extend the *Dual Pathway to Creativity Model* (DPCM) (De Dreu, Baas, & Nijstad, 2008) by including the group level, which might be called the *Dual Pathway to Creativity in Groups Model* (DPCGM). To this end, the view of groups as information processors provides a useful basis (Hinsz, Tindale, & Vollrath, 1997). It indicates that the sharing of ideas and information affects both individual- and team-level outcomes, and that cognitive processes occur not only within but also among team members. Resulting from this, we suggest that the DPCGM includes the aspect of input and its characteristics (such as novelty or diversity; see also, De Jonge et al. 2018; 2019 (Chapers 3 and 4)) and represents the cognitive pathways of flexibility and persistence at the group level. We speculate that this group-level tendency depends both on (a) the composition of the group members' intrapersonal characteristics and preferences for a specific cognitive pathway (i.e., the individual differences and states included in the DPCM), and (b) on the interpersonal characteristics and the influence people experience from each other('s input). As further research is needed, and important, to test these interpersonal and group-level positions, we invite other researchers to investigate and further elaborate on the DPCGM.

Another fruitful avenue for future research is to further bridge lines of research on creativity with those on innovation. In the current dissertation, the focus was on the outcome of creative idea generation, and on investigating how creativity can optimally occur. As a next step, it is important to gain better insight into how to move from creativity to innovation, as each requires the other. "Whereas creativity focuses on idea production, innovation includes both idea production and implementation. As such, creativity is the first and crucial stage of innovation, but predictors of ideation and implementation are likely to differ" (Zhou &

Hoever, 2014, p. 335). Creativity is necessary for innovative behavior and organizational effectiveness (Amabile, 1983; Paulus & Nijstad, 2003). But creativity in itself - without moving towards innovation or successful implementation - is not very useful for the team or organization, as it does not result in any actual changes nor stimulate the added advantage hoped for.

To this end, it is useful to investigate how we can further optimize the processes of selection and implementation of those ideas that are most promising and creative, ensuring that ideas get implemented that are both novel and feasible, and that will likely create the added value aimed for. Previous research has unfortunately indicated that selecting the creative ideas generated is not a smooth or straightforward process. People often fail to select the creative ideas for implementation, instead selecting the more common and everyday ideas (cf. Rietzschel, Nijstad, & Stroebe, 2010; Mueller, Melwani, & Goncalo, 2014). This partly has to do with a bias against creativity: although people admire creative ideas, they often reject them owing to uncertainty about their usefulness and chances of success (Mueller et al., 2014). However, selecting the more common and everyday ideas for implementation will not result in innovation. These ideas are by default not creative, but represent ideas that are more routine, mundane, and reproductive. At the same time, uncommon ideas that are different from the usual are not guaranteed to be highly creative or innovative either (Simonton, 2018). In this sense, creative idea selection can be seen as a *high risk, high gain* situation: high in risk, as the successfulness of such new ideas is uncertain, but with the possibility of high gains when the implementation of creative ideas indeed results in the innovation and success hoped for.

Given that we do not know up front whether a novel idea will indeed be useful and result in innovation, developing and testing novel ideas may require a trial and error process in the form of “blind variation and selective retention” (Campbell, 1960, p.380). Hence,

developing and implementing new ideas may require some form of risk taking by the creator, feeling more at ease to risk failure (Simonton, 2018). Related to this, previous research indicates that feelings of uncertainty and motivation to reduce uncertainty can activate the previously mentioned creativity bias. This bias activates more negative associations with creativity, and results in lower evaluations of creative ideas (Mueller et al., 2012). This relates to other research indicating that innovative behavior is stimulated when positive performance outcomes are expected, but is hindered when the focus is on image outcomes (Yuan & Woodman, 2010). Also, innovative behavior can be seen as a risky endeavor that brings not only benefits, but also costs to employees who engage in it. Costs relate to possible dissent and conflict with colleagues who want to prevent innovative change, as aiming to implement new ideas challenges the status quo in the organization (Janssen, 2003). Future research is needed to test whether risk-taking is positively related to the selection and implementation of novel ideas.

Practical Implications

It seems that people can benefit from the ideas of others (Brown et al., 1998; Dugosh et al., 2000; Stroebe, Nijstad, & Rietzschel, 2010), but only in certain circumstances. In practice, organizations and teams could benefit from our findings by taking both the person and context into account, as well as the interaction between the two, by taking on an interactionist perspective (Woodman et al., 1993). First, being aware of the individual differences of team members rather than using a ‘one size fits all’ approach is important when aiming to increase productivity and cognitive stimulation. Managers or teams could, for example, discuss individuals’ personalities, needs, and preferences with them, and investigate together how the context can be adapted to the individual to enhance their creative performance. When brainstorming is conducted in groups with several members, all members bring their own personality and preferences to this group. It is thus very unlikely that the work

setting matches everyone's needs. In these cases, team-level interventions may be necessary in order to make brainstorming work. A possible intervention is to investigate workers' psychological need patterns and to create brainstorming groups composed of workers with similar preferences. This allows for the creation of a brainstorming setting that is adapted to everyone's psychological needs (i.e., by creating a more structured versus ill-structured brainstorming setting).

Second, the positive perception of another's idea as being creative depends on its stimulating potential (Zhou et al., 2017) and on the elements of perceived novelty, feasibility, positive surprise, and disruptiveness (De Jonge et al., 2019) (Chapter 2). Our findings indicate that novel ideas open up new possibilities that have wanted and unwanted elements, which either positively or negatively affect the perception of creativity. Because of this, it may be fruitful to train people to reflect on the creative potential of various types of input (Chapter 3). People could be taught how to deal with and use original or unusual input: namely, as a useful tool to consider the topic from a new angle. Alternatively, it may help to indicate why the possible lack of feasibility of novel ideas does not have to be a problem. Seeing the idea as raw material for further development may help people to withhold immediate evaluation or rejection of such ideas in terms of their (in)feasibility. Making the revision and development of ideas a fundamental part of idea selection (see also, Lonergan, Scott, & Mumford, 2004) can help to open up the willingness to further adapt and refine novel ideas to make them implementable and valuable (Litchfield et al., 2015). Such training may be especially valuable for those high in need for structure, who tend to perceive novel ideas as disruptive rather than creative (Chapter 3). At the same time, people could be made aware of the potential benefits of receiving more common input: namely, as a starting point to activate a new train of thought, in order to generate more original ideas themselves. This may be especially useful for people high in need for autonomy, who tend to feel blocked by common ideas (Chapter 3).

Training teams to value information diversity might be a useful starting point in this regard, in order to stimulate the active consideration of the viewpoints and ideas of others. Previous research has indicated that such positive diversity beliefs increase the performance of informationally diverse groups, as they help people to elaborate more on the information shared (Homan, van Knippenberg, Van Kleef, & De Dreu, 2007). Focusing on the added value of diverse input may be practical as well, as we suspect that if one of the team members were to take on a flexibility approach by generating ideas from diverse perspectives (Chapter 4), the brainstorming group would automatically switch to sharing diverse rather than homogenous input.

Alternatively, electronic brainstorming could be implemented as a heterogeneous practice, in which different brainstorming formats are provided within the computer program used. In this case, a structured form can be provided, in which people receive input from co-workers structured per mental cluster to stimulate the persistence pathway, or an ill-structured form, in which people receive input from different mental categories at random to stimulate the flexibility pathway. Based on their personalities, needs, and preferences, individual group members can select what type of brainstorming suits them best (Chapter 4). This fit can increase workers' motivation to attend to input from others, which in turn increases creative performance (Dugosh et al., 2000). Also, people could be informed about the two possible cognitive pathways (namely, flexibility and persistence) to idea generation, and that these seem to work well for different types of input. As people seemed to be able to take on a new cognitive pathway that differed from their usual tendency (Chapter 4), such training could aid the implementation of the cognitive pathway that most likely stimulates further idea generation in a certain situation. Such interventions hopefully increase the likelihood that individuals and teams can benefit from the input they receive, and can see the added value of various types of input in generating creative ideas themselves.

Conclusion

My key motivation in writing this dissertation on creativity was to understand why and how a context that is effective and stimulating for one person's creativity can be ineffective and hindering for another. The findings presented in this dissertation indicate that 'one size does not fit all', and that different people thrive in different contexts. We showed that both wanted (i.e., perceived novelty and positive surprise) and unwanted elements (i.e., expected low feasibility and disruptiveness) are inherently associated with novel ideas, and that these elements differently affect the perceptions of creativity and effectiveness of novel ideas. Focusing on creative idea generation, we found that the effectiveness of various input (input high or low in novelty or diversity) depends on and interacts with people's individual differences. These research findings highlight the importance of matching person and context to attain creative performance. We encourage other researchers to investigate and further elaborate on the actor-context interplay, and to investigate the actor component from various levels (i.e., the person, team, and organizational levels). The current as well as future research will hopefully help us to better understand the mechanisms through which creative performance unfolds, and enable us to create the ideal circumstances for people to generate creative ideas when brainstorming.

6

Summary

The identification of novel ideas as a creative contribution is key to new product development and innovation, but little is known of what constitutes a creative idea, why, and for whom, and for doing what. By investigating these questions (Chapter 2), we found that the perception of creativity seems to imply some sort of valuation or appreciation of the idea (Runco & Smith, 1992), and is affected by the perception of novelty, feasibility, positive surprise and disruptiveness. Creativity perceptions were constituted similarly for laypeople and experts, and affected the expected success of novel ideas, the willingness to endorse implementation, and the perceived added value for further idea generation. Knowing this, we tested if and how well people are actually able to use novel ideas as a starting point for further idea generation, and expected this to differ per person (Chapter 3). Given that group work is ubiquitous in modern organizations, and that group brainstorming remains highly popular despite the risks of productivity loss, we found it important to understand more about the factors that contribute to (or inhibit) creative idea generation. Although recognizing creativity revolves around the perception of other people's ideas, whereas cognitive stimulation concerns generating ideas oneself, our findings suggest that the two processes are strongly interrelated. We expected and found that the indirect effect of input novelty on cognitive

stimulation through perceived creativity is affected by individual differences, in this case, the need for structure and autonomy. Last, we focused on individual differences in approach-avoidance motivation and their tendency to use a specific cognitive pathway when brainstorming, in order to investigate what type of input (diverse or homogenous) would be optimal for cognitive stimulation to occur (Chapter 4). Our findings suggested that both approach motivated and avoidance motivated people seem to use input as an important additional search cue, and are stimulated to follow the cognitive pathway that aligns with the diversity level of the input. The findings in these three chapters together show various interplays between person and situation, and give us more insight into when and how ideas are perceived as a creative contribution, and help us understand the circumstances that stimulate rather than harm creative performance.

7

Dutch Summary

Nederlandse Samenvatting

De identificatie van vernieuwende ideeën als creatieve bijdrage is essentieel voor nieuwe productontwikkeling en innovatie, maar er is weinig bekend over wat een idee creatief maakt, waarom en voor wie dit zo is, en voor welk doeleinde. Door deze vragen te onderzoeken (Hoofdstuk 2), ontdekten we dat de perceptie van creativiteit een vorm van waardering van het idee lijkt te impliceren (Runco & Smith, 1992) en wordt beïnvloed door de perceptie van nieuwheid, haalbaarheid, positieve verrassing en disruptiviteit. Creativiteitspercepties werden op dezelfde manier gevormd voor leken en experts, en beïnvloedden het verwachte succes van nieuwe ideeën, de bereidheid over te gaan tot implementatie, en de verwachte toegevoegde waarde voor verdere ideeëngeneratie. Dit wetende, hebben we getest of en hoe goed men daadwerkelijk in staat is om vernieuwende ideeën te gebruiken als uitgangspunt voor verdere ideeëngeneratie, met de verwachting dat dit per persoon zou verschillen (Hoofdstuk 3). Gezien groepswerk een kernonderdeel is in veel moderne organisaties en dat groep brainstormen ondanks de risico's van productiviteitsverlies zeer populair blijft, vonden we het belangrijk om meer te weten te komen over de factoren die

aan creatieve ideeëngeneratie bijdragen (of deze juist afremmen). Hoewel het herkennen van creativiteit draait om de perceptie van andermans ideeën, terwijl cognitieve stimulatie betrekking heeft op het zelf genereren van ideeën, suggereren onze bevindingen dat deze twee processen sterk met elkaar samenhangen. We verwachtten en vonden dat het indirecte effect van vernieuwende input op cognitieve stimulatie door gepercipieerde creativiteit beïnvloed wordt door individuele verschillen, in dit geval de behoefte aan structuur en autonomie. Tot slot hebben we ons gericht op individuele verschillen in benaderings- en vermijdingsmotivatie en de neiging om een specifieke cognitieve route te gebruiken bij het brainstormen, om te onderzoeken welk type input (divers of homogeen) optimaal zou zijn voor cognitieve stimulatie (Hoofdstuk 4). Onze bevindingen suggereerden dat zowel degenen met een benaderings- alsook degenen met een vermijdingsmotivatie input gebruiken als een belangrijk aanvullend zoeksignaal, en geneigd zijn het cognitieve pad te volgen dat aansluit bij het diversiteitniveau van de input. De bevindingen in deze drie hoofdstukken tezamen tonen een variantie aan interacties tussen persoon en situatie, en geven ons meer inzicht in wanneer en hoe ideeën als een creatieve bijdrage worden ervaren, en helpen ons de omstandigheden te begrijpen die creatieve prestaties stimuleren in plaats van belemmeren.

8

Popular Summary

The core focus in this dissertation was on how to optimally match person and context to ensure that people perceive the creativity in novel ideas, and to stimulate optimal creative performance and task enjoyment. We expected and found that different people thrive in different contexts. First, we found that the perception of creativity seems to imply some sort of valuation of the idea, and is affected by the perception of novelty, feasibility, positive surprise, and disruptiveness. Perceptions of creativity were constituted similarly for laypeople and experts, and affected the expectations of success of novel ideas, willingness to endorse their implementation, and their perceived added value for further idea generation.

Next, we tested if and how well people were actually able to use novel ideas as a starting point for further idea generation, and expected and found that this differed per person (in this case, affected by people's psychological needs for structure and autonomy). Where some people could perform well when receiving novel ideas, others could brainstorm better when receiving more everyday non-novel ideas.

Last, different people (approach- or avoidance-motivated people) either generate ideas from many different perspectives versus one perspective when brainstorming, and we investigated whether receiving diverse or non-diverse input is optimal for their performance. Our findings indicate that people adapt their brainstorming style to the input, and that this increases their idea generation. Given that group brainstorming remains highly popular in modern organizations, we hope that implementing these findings increases creative idea generation.

Populaire samenvatting

De focus in dit proefschrift was de vraag hoe je optimaal persoon en context kunt afstemmen om ervoor te zorgen dat mensen de creativiteit in nieuwe ideeën waarnemen, en tot creatieve prestaties en werkplezier komen. We verwachtten en vonden dat verschillende mensen in verschillende contexten floreren. Allereerst vonden we dat de waargenomen creativiteit van een idee te maken heeft met de waardering ervan, en wordt beïnvloed door de waargenomen vernieuwing, haalbaarheid, positieve verrassing en disruptiviteit. De perceptie van creativiteit werd op dezelfde manier gevormd voor leken en experts. Dit beïnvloedde het verwachte succes van nieuwe ideeën, de intentie om implementatie te ondersteunen, en de ervaren meerwaarde van deze ideeën als startpunt voor verdere ideeëngeneratie.

Vervolgens hebben we getest of en hoe goed mensen daadwerkelijk in staat zijn om nieuwe ideeën te gebruiken als uitgangspunt voor verdere ideeëngeneratie, en we verwachtten en vonden dat dit per persoon verschilde (beïnvloed door de psychologische behoeften aan structuur en autonomie). Waar sommige mensen goed konden presteren bij het ontvangen van nieuwe ideeën, konden anderen beter brainstormen met meer alledaagse niet-vernieuwende ideeën.

Tot slot, verschillende mensen (benaderings- of vermijdingsgemotiveerde mensen) genereren ideeën juist vanuit veel verschillende invalshoeken of vanuit één perspectief tijdens het brainstormen. We onderzochten of het ontvangen van diverse of niet-diverse ideeën optimaal is voor hun prestaties. Onze bevindingen toonden dat mensen hun brainstormstijl aanpassen aan de input, en dat dit hun ideeëngeneratie vergroot. Gezien groepsbrainstorming erg populair is in moderne organisaties, hopen we dat het implementeren van deze bevindingen de creatieve ideeëngeneratie vergroot.

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Appendix A

Summary[5] **Category Coding System: Health** (Diehl, 1991)

Brainstorm Question: "What can people do to maintain or improve their health?"

Goal X Means matrix (12 goals, 10 means).

Fundamental choices

Goals:

00: unspecified goal
01: improve or maintain bodily fitness (muscles, cardiovascular system, etc…)
02: maintain sensory/perceptual performance (e.g. vision, hearing, tactile sense)
03: optimize metabolic function and avoid metabolic dysfunction (digestion, breathing, skin)
04: protect the skeletal system (spinal column, joints, bones, ligaments, tendons etc..) and avoid straining it by sitting/standing in a poor position
05: avoid being over- or under-weight
* also includes all topics that touch upon avoiding fat
06: avoid bodily injuries (e.g. cuts, burns, etc…)
07: maintain, improve or regain psychological health
08: avoid bodily overexertion
09: avoid poison, radiation or the uptake/intake of any harmful products (e.g. nicotine, drugs, etc…)
10: practice disease prevention
11: maintain healthy teeth and gums

Means:

0: unspecified mean
1: nutrition (food, recreational drugs)
2: medicines and (medical) treatment
3: clothing
4: taking care of one's body
5: avoiding, seeking out or changing environmental influences
* also governmental interventions/actions/prescriptions, providing people with options, subsidizing things, making things cheaper, etc.
6: physical activity
7: information and advice
* collecting and exchanging information, keeping a journal
8: lifestyle (health-relevant behavior and attitudes)
* also general outlook on life and health, being positive, routines, habits
9: social contacts

General Explanation Category Coding System

Participants generated ideas concerning the brainstorm question: "What can people do to maintain or improve their health?". This topic was chosen at is it used more often, and a category coding system was previously created for this by Diehl (1991). The category coding system is used to indicate to which perspective (i.e., category) a produced idea belongs. The coding system specifies 12 goals and 10 means to reach this goal. Crossing both results in a total of 120 possible categories that a brainstorm idea can belong to. See above for a complete overview of all possible categories.

Example. Category 015 contains ideas focusing on ` improve or maintain bodily fitness (muscles, cardiovascular system, etc.) *through* avoiding, seeking out or changing environmental influences'. Example ideas that are coded as belonging to this category (015) are: 'Halve the prices for sports centers.' and 'At certain places in the University buildings, you are no longer allowed to walk, only crawling is allowed.'

This category combines goal 01 (improve or maintain bodily fitness (muscles, cardiovascular system, etc.)) and means 5 (avoiding, seeking out or changing environmental influences). Category 016 focuses on the same goal (goal category 01, bodily fitness), but through a different means (means category 6, physical activity). Example ideas belonging to this category (016) are: 'Do lots of sports.' And 'Walk instead of taking the car.'

Explanation of the Input Conditions Based on the Category Coding System

Homogeneous condition. Participants in the homogeneous condition received ideas from 1 category, either being category 016 (bodily fitness *through* physical activity), 031 (optimize metabolic function and avoid metabolic dysfunction *through* nutrition), or 075 (maintain, improve or regain psychological health *through* avoiding, seeking out or changing environmental influences). The brainstorming software was designed in such a manner that one

of these three files was randomly drawn to provide participants with ideas in the homogeneous input condition. We created three different files to ensure that the effects of homogenous input could not be attributed to one specific category. Also, these categories contained at least 100 different ideas, so that the specific ideas displayed to participants could be randomly drawn from this category.

Being in the homogeneous condition with category 016, the participant would thus for example receive ideas such as: “Do lots of sports”, “Walk instead of taking the car”, “Do abdominal exercises do if you are at a boring class”, “Let your bike tires half empty, so that cycling is extra difficult”, etc.

Diverse structured condition. Participants in the diverse conditions received ideas from all possible categories that contained at least five different ideas, to ensure the possibility for structured diverse input. In the diverse structured condition, five different ideas within one category were randomly drawn without replacement and displayed one at a time to the participant, before randomly moving to another category. In practice, this could for example result in randomly receiving 5 ideas from category 016 (such as depicted above), and then randomly moving to category 045 (protect the skeletal system *though* avoiding, seeking out or changing environmental influences), receiving ideas such as: “Use a good pillow”, ”Watch out for RSI”, “Furniture that promotes your posture”, “Skippy balls where people have to sit”, and “Install anti-RSI software”, then again randomly moving to another category.

Diverse unstructured condition. In the diverse unstructured condition, one idea from a category was randomly drawn without replacement and displayed, before randomly moving to another category, displaying a different idea. For example, this could result in receiving one idea from category 015 (e.g., “Halve the prices for sports centers”), then from category 051 (e.g., “Fewer trips to the cafeteria”), then from category 114 (e.g., “Brush your teeth”), etc.

Chapter 4: Table 3a. *Bootstrap Results for each of the Mediators and Moderators – Study 1*

	Homogeneous input vs. NI		Diverse uncategorized input vs. NI		Diverse categorized input vs. NI	
Approach motivation	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect: Input → Fluency	**-4.13 (1.27)**	**[-6.64; -1.60]**	-2.05 (1.23)	[-4.50; .40]	**-3.04 (1.28)**	**[-5.57; -.51]**
Mediator effects						
Input → Flexibility	**-14.13 (5.52)**	**[-25.08; -3.19]**	**5.46 (6.29)**	**[-7.01; 17.94]**	**15.40 (4.79)**	**[5.89; 24.90]**
Flexibility → Fluency	**2.20 (.86)**	**[.49; 3.90]**	**2.20 (.86)**	**[.49; 3.90]**	**2.20 (.86)**	**[.49; 3.90]**
Input → Persistence	-.97 (2.11)	[-5.15; 3.20]	1.78 (2.32)	[-2.82; 6.37]	.81 (1.82)	[-2.78; 4.40]
Persistence → Fluency	**9.63 (2.87)**	**[3.93; 15.33]**	**9.63 (2.87)**	**[3.93; 15.33]**	**9.63 (2.87)**	**[3.93; 15.33]**
Moderator effects						
Input x Motivation → Flexibility	**3.10 (1.04)**	**[1.03; 5.17]**	-.23 (1.16)	[-2.53; 2.07]	**-2.02 (.90)**	**[-3.81; -.23]**
Flexibility x Motivation → Fluency	.25 (.16)	[-.07; .58]	.25 (.16)	[-.07; .58]	.25 (.16)	[-.07; .58]
Input x Motivation → Persistence	.49 (.40)	[-.30; 1.28]	-.22 (.43)	[-1.06; .63]	-.09 (.34)	[-.76; .59]
Persistence x Motivation → Fluency	-.20 (.54)	[-1.27; .87]	-.20 (.54)	[-1.27; .87]	-.20 (.54)	[-1.27; .87]

Note. If CI does not include zero, the effect is considered statistically significant and is displayed in bold. $n = 108$.

Chaper 4: Table 3b. *Bootstrap Results for each of the Mediators and Moderators – Study 1*

	Homogeneous input vs. NI		Diverse uncategorized input vs. NI		Diverse categorized input vs. NI	
Avoidance motivation	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect: Input → Fluency	**-3.70 (1.25)**	**[-6.18; -1.21]**	-1.87 (1.25)	[-4.34; .61]	**-.25 (1.29)**	**[-5.82; -.69]**
Mediator effects						
Input → Flexibility	1.57 (3.03)	[-4.46; 7.59]	5.22 (2.75)	[-.23; 10.67]	.21 (2.66)	[-5.08; 5.50]
Flexibility → Fluency	**3.39 (.45)**	**[2.49; 4.30]**	**3.39 (.45)**	**[2.49; 4.30]**	**3.39 (.45)**	**[2.49; 4.30]**
Input → Persistence	.07 (1.11)	[-2.13; 2.27]	1.06 (1.01)	[-.95; 3.07]	1.24 (.99)	[-.74; 3.21]
Persistence → Fluency	**8.96 (1.43)**	**[6.12; 11.80]**	**8.96 (1.43)**	**[6.12; 11.80]**	**8.96 (1.43)**	**[6.12; 11.80]**
Moderator effects						
Input x Motivation → Flexibility	.11 (.67)	[-1.22; 1.44]	-.24 (.62)	[-1.47; 1.00]	1.14 (.62)	[-.09; 2.37]
Flexibility x Motivation → Fluency	.02 (.09)	[-.16; .21]	.02 (.09)	[-.16; .21]	.02 (.09)	[-.16; .22]
Input x Motivation → Persistence	.35 (.25)	[-.14; .83]	-.11 (.23)	[-.56; .35]	-.22 (.23)	[-.67; .24]
Persistence x Motivation → Fluency	-.10 (.33)	[-.75; .55]	-.10 (.33)	[-.75; .55]	-.10 (.33)	[-.75; .55]

Chaper 4: Table 3c. *Bootstrap Results for each of the Mediators and Moderators – Study 1*

	Diverse uncategorized input vs. homogeneous input		Diverse categorized input vs. homogeneous input		Diverse categorized input vs. diverse uncategorized input	
Approach motivation	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect: Input → Fluency	2.07 (1.16)	[-.23; 4.37]	1.09 (1.24)	[-1.37; 3.54]	-.99 (1.11)	[-3.18; 1.21]
Mediator effects						
Input → Flexibility	3.39 (6.21)	[-8.93; 15.71]	**13.04 (4.65)**	**[3.81; 22.27]**	**11.06 (4.74)**	**[1.66; 20.46]**
Flexibility → Fluency	**2.20 (.86)**	**[.49; 3.90]**	**2.20 (.86)**	**[.49; 3.90]**	**2.20 (.86)**	**[.49; 3.90]**
Input → Persistence	.18 (2.29)	[-4.36; 4.72]	-.78 (1.76)	[-4.27; 2.70]	.19 (1.79)	[-3.36; 3.74]
Persistence → Fluency	**9.63 (2.87)**	**[3.93; 15.33]**	**9.63 (2.87)**	**[3.93; 15.33]**	**9.63 (2.87)**	**[3.93; 15.33]**
Moderator effects						
Input x Motivation → Flexibility	-.23 (1.16)	[-2.53; 2.07]	**-2.02 (.90)**	**[-3.81; -.23]**	**-2.02 (.90)**	**[-3.81; -.23]**
Flexibility x Motivation → Fluency	.25 (.16)	[-.07; .58]	.25 (.16)	[-.07; .58]	.25 (.16)	[-.07; .58]
Input x Motivation → Persistence	-.22 (.43)	[-1.06; .63]	-.09 (.34)	[-.76; .59]	.09 (.34)	[-.76; .59]
Persistence x Motivation → Fluency	-.20 (.53)	[-1.27; .87]	-.20 (.54)	[-1.27; .87]	-.20 (.54)	[-1.27; .87]

Chaper 4: Table 3d. *Bootstrap Results for each of the Mediators and Moderators – Study 1*

	Diverse uncategorized input vs. homogeneous input		Diverse categorized input vs. homogeneous input		Diverse categorized input vs. diverse uncategorized input	
Avoidance motivation	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect: Input → Fluency	1.83 (1.17)	[-.49; 4.16]	.44 (1.20)	[-1.95; 2.83]	-1.39 (1.09)	[-3.56; .78]
Mediator effects						
Input → Flexibility	3.16 (2.74)	[-2.27; 8.60]	-1.80 (2.63)	[-7.02; 3.41]	-3.91 (2.61)	[-9.07;1.26]
Flexibility → Fluency	**3.39 (.45)**	**[2.49; 4.30]**	**3.39 (.45)**	**[2.49; 4.30]**	**3.39 (.46)**	**[2.49; 4.30]**
Input → Persistence	-.52 (1.01)	[-2.53; 1.48]	-.35 (.98)	[-2.30; 1.60]	.60 (.97)	[-1.32; 2.53]
Persistence → Fluency	**8.96 (1.43)**	**[6.12; 11.80]**	**8.96 (1.43)**	**[6.12; 11.80]**	**8.96 (1.43)**	**[6.12; 11.80]**
Moderator effects						
Input x Motivation → Flexibility	-.24 (.62)	[-1.47; 1.00]	1.13 (.62)	[-.09; 2.37]	1.14 (.62)	[-.09; 2.37]
Flexibility x Motivation → Fluency	.02 (.09)	[-.16; .21]	.02 (.09)	[-.16; .21]	.02 (.09)	[-.16; .21]
Input x Motivation → Persistence	-.11 (.23)	[-.56; .35]	-.22 (.23)	[-.67; .24]	-.22 (.23)	[-.67; .24]
Persistence x Motivation → Fluency	-.10 (.33)	[-.75; .55]	-.10 (.33)	[-.75; .55]	-.10 (.33)	[-.75; .55]

Chaper 4: Table 6a. *Bootstrap Results for each of the Mediators and Moderators – Study 2*

	Homogeneous input vs. NI		Diverse uncategorized input vs. NI		Diverse categorized input vs. NI	
Approach motivation	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect: Input → Fluency	-.72 (1.59)	[-3.86; 2.43]	.54 (1.53)	[-2.49; 3.57]	-1.01 (1.54)	[-4.06; 2.04]
Mediator effects						
Input → Flexibility	-2.71 (5.82)	[-14.24; 8.82]	4.39 (4.80)	[-5.11; 13.90]	.23 (4.68)	[-9.04; 9.50]
Flexibility → Fluency	**3.54 (1.26)**	**[1.04; 6.05]**	**3.54 (1.26)**	**[1.04; 6.05]**	**3.54 (1.26)**	**[1.04; 6.05]**
Input → Persistence	-5.30 (3.30)	[-11.83; 1.23]	2.65 (2.77)	[-2.85; 8.14]	1.97 (2.71)	[-3.40; 7.34]
Persistence → Fluency	**8.85 (2.18)**	**[4.53; 13.16]**	**8.85 (2.18)**	**[4.53; 13.16]**	**8.85 (2.18)**	**[4.53; 13.16]**
Moderator effects						
Input x Motivation → Flexibility	.71 (1.06)	[-1.40; 2.82]	-.26 (.88)	[-2.02; 1.49]	.62 (.85)	[-1.07; 2.31]
Flexibility x Motivation → Fluency	.02 (.23)	[-.43; .47]	.02 (.23)	[-.43; .47]	.02 (.23)	[-.43; .47]
Input x Motivation → Persistence	**1.40 (.60)**	**[.21; 2.60]**	-.32 (.51)	[-1.33; .70]	-.26 (.49)	[-1.24; .72]
Persistence x Motivation → Fluency	-.55 (.39)	[-1.33; .23]	-.55 (.39)	[-1.33; .23]	-.55 (.39)	[-1.33; .23]

Note. If CI does not include zero, the effect is considered statistically significant and is displayed in bold. $n = 122$.

Chaper 4: Table 6b. *Bootstrap Results for each of the Mediators and Moderators – Study 2*

	Homogeneous input vs. NI		Diverse uncategorized input vs. NI		Diverse categorized input vs. NI	
Avoidance motivation	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect: Input → Fluency	-1.20 (1.55)	[-4.26; 1.86]	.63 (1.49)	[-2.33; 3.59]	-.99 (1.50)	[-3.96; 1.99]
Mediator effects						
Input → Flexibility	1.98 (2.45)	[-2.87; 6.83]	2.30 (2.59)	[-2.82; 7.43]	2.83 (2.39)	[-1.91; 7.57]
Flexibility → Fluency	**3.80 (.62)**	**[2.57; 5.04]**	**3.80 (.62)**	**[2.57; 5.04]**	**3.80 (.62)**	**[2.57; 5.04]**
Input → Persistence	**4.20 (1.41)**	**[1.41; 6.98]**	.78 (1.50)	[-2.19; 3.75]	.82 (1.38)	[-1.92; 3.56]
Persistence → Fluency	**8.65 (1.07)**	**[6.53; 10.77]**	**8.65 (1.07)**	**[6.53; 10.77]**	**8.65 (1.07)**	**[6.53; 10.77]**
Moderator effects						
Input x Motivation → Flexibility	-.20 (.57)	[-1.32; .92]	.17 (.62)	[-1.06; 1.40]	.19 (.56)	[-.92; 1.29]
Flexibility x Motivation → Fluency	-.05 (.14)	[-.33; .22]	-.05 (.14)	[-.33; .22]	-.05 (.14)	[-.33; .22]
Input x Motivation → Persistence	-.45 (.32)	[-1.10; .19]	.04 (.36)	[-.67; .76]	-.07 (.32)	[-.70; .57]
Persistence x Motivation → Fluency	**-.69 (.25)**	**[-1.18; -.19]**	**-.69 (.25)**	**[-1.18; -.19]**	**-.69 (.25)**	**[-1.18; -.19]**

Chaper 4: Table 6c. *Bootstrap Results for each of the Mediators and Moderators – Study 2*

	Diverse uncategorized input vs. homogeneous input		Diverse categorized input vs. homogeneous input		Diverse categorized input vs. diverse uncategorized input	
Approach motivation	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect: Input → Fluency	1.26 (1.50)	[-1.71; 4.23]	-.29 (1.54)	[-3.34; 2.76]	-1.55 (1.40)	[-4.33; 1.23]
Mediator effects						
Input → Flexibility	3.26 (4.82)	[-6.29; 12.81]	-.93 (4.71)	[-10.25; 8.39]	-2.76 (4.69)	[-12.04; 6.52]
Flexibility → Fluency	**3.54 (1.26)**	**[1.04; 6.05]**	**3.54 (1.26)**	**[1.04; 6.05]**	**3.54 (1.26)**	**[1.04; 6.05]**
Input → Persistence	.34 (2.79)	[-5.18; 5.86]	-.35 (2.73)	[-5.75; 5.05]	1.01 (2.71)	[-4.36; 6.39]
Persistence → Fluency	**8.85 (2.18)**	**[4.53; 13.16]**	**8.85 (2.18)**	**[4.53; 13.16]**	**8.85 (2.18)**	**[4.53; 13.16]**
Moderator effects						
Input x Motivation → Flexibility	-.26 (.88)	[-2.02; 1.49]	-1.16 (.74)	[-2.63; .31]	.62 (.85)	[-1.07; 2.31]
Flexibility x Motivation → Fluency	.02 (.23)	[-.43; .47]	.02 (.23)	[-.43; .47]	.02 (.23)	[-.43; .47]
Input x Motivation → Persistence	-.32 (.51)	[-1.33; .70]	-.26 (.49)	[-1.24; .72]	-.26 (.49)	[-1.24; .72]
Persistence x Motivation → Fluency	-.55 (.39)	[-1.33; .23]	-.55 (.39)	[-1.33; .23]	-.55 (.39)	[-1.33; .23]

Chaper 4: Table 6d. *Bootstrap Results for each of the Mediators and Moderators – Study 2*

	Diverse uncategorized input vs. homogeneous input		Diverse categorized input vs. homogeneous input		Diverse categorized input vs. diverse uncategorized input	
Avoidance motivation	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*	*b-value* (SE)	*95% CI*
Direct effect: Input → Fluency	1.83 (1.47)	[-1.07; 4.74]	.22 (1.51)	[-2.77; 3.21]	-1.61 (1.37)	[-4.33; 1.10]
Mediator effects						
Input → Flexibility	1.16 (2.59)	[-3.97; 6.29]	1.69 (2.39)	[-3.05; 6.43]	-.15 (2.37)	[-4.84; 4.55]
Flexibility → Fluency	**3.80 (.62)**	**[2.57; 5.04]**	**3.80 (.62)**	**[2.57; 5.04]**	**3.80 (.62)**	**[2.57; 5.04]**
Input → Persistence	-1.54 (1.50)	[-4.51; 1.43]	-1.50 (1.39)	[-4.24; 1.24]	-.14 (1.37)	[-2.85; 2.58]
Persistence → Fluency	**8.65 (1.07)**	**[6.53; 10.77]**	**8.65 (1.07)**	**[6.53; 10.77]**	**8.65 (1.07)**	**[6.53; 10.77]**
Moderator effects						
Input x Motivation → Flexibility	.17 (.62)	[-1.06; 1.40]	.19 (.56)	[-.92; 1.29]	.19 (.56)	[-.92; 1.29]
Flexibility x Motivation → Fluency	-.05 (.14)	[-.33; .22]	-.05 (.14)	[-.33; .22]	-.05 (.14)	[-.33; .22]
Input x Motivation → Persistence	.04 (.36)	[-.67; .76]	-.07 (.32)	[-.70; .57]	-.07 (.32)	[-.70; .57]
Persistence x Motivation → Fluency	**-.69 (.25)**	**[-1.18; -.19]**	**-.69 (.25)**	**[-1.18; -.19]**	**-.69 (.25)**	**[-1.18; -.19]**

Dankwoord

Dankwoord

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About the Author

Kiki M. M. De Jonge (1991) works as an Assistant Professor within the department of Organizational Psychology and as a Coach at Groeiflow. As a psychologist and researcher, I am interested in creativity, flow, and coaching. My focus is on the optimal fit between the needs of individuals and the work context, to optimize outcomes for both the employee and the organization (e.g., work enjoyment, performance). It inspires me to work on the edge of knowledge development that has an impact on both theory and practice.

I'm interested in the way in which sharing ideas stimulates people's creativity, and how this differs per person. Whereas novel and flexible ideas will be beneficial for some, others' creativity and productivity will benefit more from everyday and structured ideas. Also, I'm interested in how flow experiences help to reach one's full potential, and how such an experience adds to (creative) performance. As a coach, my drive as well as my specialism lies in guiding professionals towards more flow in their work, and in stimulating them to take on the positive challenges that fit their qualities (see www.Groeiflow.nl).

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07/2018-present Assistant Professor I-O Psychology at the University of Groningen. (www.kikidejonge.nl) Responsible for:
- Research lines: Creativity, Flow, Coaching
- Innovating education: activating and intensifying the I-O Psychology program
- A.O. lecturer master course Coaching, incl. supervising coaching sessions

2017-present Founder - Coach and Trainer at Groeiflow (www.Groeiflow.nl). My main activities include:
- Career and business coaching for professionals and high potentials
- Developer and trainer: Career workshops for e.g. PhD and ReMa students, Coaching and skill development for practitioners (postgraduate)
- Assessments for selection procedures

09/2014-06/2018 PhD researcher I-O Psychology at the University of Groningen.
- Thesis: Stimulating Creativity: Matching Person and Context (this dissertation).

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